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The Central Telephone Office at Paris.

(*Translated for the* Review *from La Lumière Electrique*). IX:110

Several articles in this journal have been devoted to the subject of the organization of the telephone system of Paris, and we have seen that within three years it has attained unexpected proportions. To-day it comprises nearly 3,000 subscribers, and although this number may not be very considerable in proportion to the population, since, as we have seen in a preceding number, it only exceeds by a very small amount one subscriber per 1,000 inhabitants, still it represents a total which is the largest that can be claimed by any one city.*

The system is to-day served, as has been before stated, by 10 central offices, situated as follows: No. 27 Avenue de L'Opèra, No. 4 Rue Logelbach, No. 10 Place de la Republique, No. 204 *bis* Boulevard de la Villette, Nos. 24 and 26 Rue de Lyon, No. 20 Avenue des Gobelins, No. 62 Rue du Bac, No. 123 Rue Lecourbe, No. 80 Rue de Passy, No. 42 Rue de Lafayette; but another is in process of organization at No. 25 Rue Etienne-Marcel, which will relieve that of the Avenue de L'Opèra, which is the most important of all.

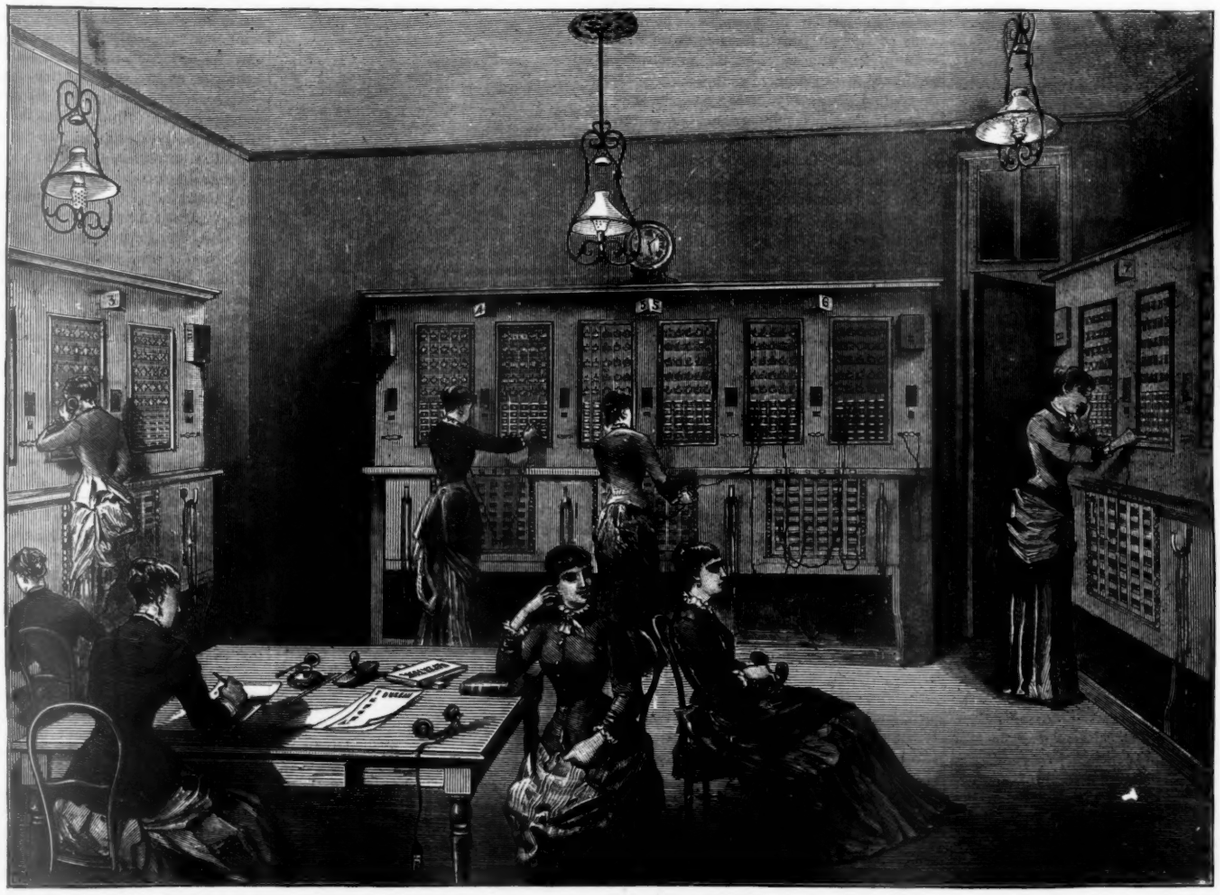
On January 1st, 1883, the latter office had 788 subscribers, and the next in order of importance is that in the Rue Lafayette, which supplies that portion of the system lying north of the boulevards. It is the latter which is illustrated in our engraving, and the number of subscribers with which it is in direct communication was on January 1st, 392.

In the article published in our number of December 28th, 1881, we described in detail the central office of the Avenue de L'Opera where all the trunk lines for inter-communication between the central offices terminate, and which in consequence of its importance is divided into two compartments by a double partition to which the commutators and annunciators are attached. We shall return soon to that arrangement and give an exact representation of it, but we wish now to show from the example under consideration that central offices can be as well organized without changing anything in the ordinary arrangements of the room, and the office of the Rue Lafayette is an instance of this kind of arrangement.

In this office the partitions which support the switches and annunciators are placed, as shown in the sketch, in front of the walls on three sides of the room. Light is admitted on the fourth side. The distance between the walls and the partitions is just sufficient to allow working-room to readily make all the electrical connections of the subscribers and the office with the switches and annunciators which are on the other side of the partition.

The jack-knife switches as well as the annunciator plates are divided into groups of twenty-five on boards which, as may be seen by referring to the illustration, are of the number of six on the lower partition. The annunciator plates are above, the switches below, and the wires which connect them are placed so that their relative position may be always the same, so that by inspection of the number of the plate of the annunciator which falls one immediately knows in which switch to place the plug which establishes the telephonic connection. Beneath the boards of which we have just spoken, is placed a shelf for the convenience of the employes, and under this shelf are other layer-boards, each of which correspond in position to two of the upper boards. Cases with borders terminate inferiorly these fronts. Lastly, between each couple of upper boards there are triangular indices on which are painted figures and tints of different colors. The call-bells, which are common to all of the subscribers in the same series, are placed at the extremities of the partitions, and between the different upper boards are placed the switches for temporary connections between the subscribers and the employees. We shall now see how all these arrangements work in practice.

The service by day is carried on by sixteen young ladies, and at night by a much smaller number of men. In the offices where the switches are placed on a single partition, as at the Avenue de L'Opera, the girls who are not actually employed for the moment, sit on long settees placed in front of the partition, but in the office where the partitions are not in a straight line, chairs are used instead of benches, and our illustration gives a correct idea of the arrangement then



The Central Telephone Office at Paris.

* This is an error. The Metropolitan Telephone and Telegraph Company of New York City now has 3,500 subscribers.—Ed. Review.

used. The directress sits before a table and can easily oversee her assistants. To avoid exterior noises, the doors are covered with baize and the walls are covered with moleskin, and are often covered with baize in addition, for the same reason.

To each central office is attached an inspector who is charged with the surveillance of the apparatus and wires of the office, with the testing of the lines and the location of faults when they occur; he has under his orders one or more assistants who repair derangements, oversee the batteries, and by means of commutators, change them once every half hour. When the office is important, like the one which we are now describing, there is an instructor who trains he supernumerary young girls, and for this purpose a private room is fitted up for all the exercises necessary for this kind of instruction. As it often happens that the portable apparatus used by the employes for communication with the subscribers become deranged, a place is appropriated for testing them, and after examination, they are sent, if necessary, to the company's shops at Grenelle, to be repaired.

All the requirements of the service are regularly fulfilled, and the most perfect order reigns in the offices. The regulations are even very severe in respect to the communication between the outside public and the young ladies employed in the service; no one is admitted to the offices without a special authorization. When a subscriber has any inquiries to make he must address himself to the directress, and she receives you in a saloon completely separated from the office. In fact, everything is arranged in the most convenient manner, and the service is perfect, although some persons think otherwise who make no allowance for different things, thus making the central office responsible for the negligence or delays which are most frequently caused by the subscribers themselves. It often happens that subscribers when called are absent, or unwilling to be disturbed, but even in the latter case, the central office notifies the caller, at the expiration of some minutes, that the subscriber called has not responded. It is true that in certain offices and at certain hours of the day, particularly at the hours while the Bourse is in session the service is surcharged to such a degree that prompt answers cannot be given to all the subscribers; but the detentions are never long, and only seem so because time always passes very slowly when one is waiting.

It now remains for us to indicate the method of connecting the subscribers and the central offices with each other.

We have seen that between each couple of sections there is a sort of triangular prism, painted on one side and carrying a number on the other. The color of the painted portion of this prism indicates that the board on that side corresponds to the auxiliary wires which connect this section with that of all the offices in Paris bearing the same color, and as the connection of these sections with the subscribers whose switches are distributed on the different sections of the room, and even the connection of the sections of the different subscribers of the same office between each other, would often necessitate very long and cumbersome flexible cords, each one of all of the sections corresponds to the lower boards, which consequently contain the connections with all of the sections of the office, and with all of the central offices of the system.

Therefore, when a subscriber of the Rue Lafayette office, which is called number L, wishes to speak to Passy, for instance, the employe of office L must establish the connection of the subscriber with the corresponding board at the Passy office. If this board is the adjoining one to that in which is contained the switch of the calling subscriber, the connection is made directly from one board to the other by portable cords, which the employes have at their disposal; but, if the board in question is at some distance, the connection is made with the lower board, and on the range of switches which corresponds to the color of the Passy office, a color which is found indicated like the others of the left of the switches of these boards. The connection being thus effected, the Passy office is asked to connect the subscriber called, and this office establishes in the same manner the communication between that subscriber whom he has called and the board at the Rue Lafayette office. After that, conversation can be exchanged between the two subscribers, and it would be the same between two subscribers of the same office if the boards where their switches are placed are very far apart. We will add that for reasons of order and regularity in the service, all the auxiliary wires which connect the central offices together, pass through the central office of the Avenue de l'Opera, where they are joined together on special circular connecting-boards (called *rosaces*, from their resemblance to the shape of a rose-blossom); and it is for this purpose that the second *rosace* chamber is arranged in the basement of that office, as described in our article of December 28th, 1881.

The subscribers' wires are bunched together in cables, which generally contain fourteen wires; they are attached to the vaults of the sewers, and are laid by the Administration of Telegraph lines, to which the company pays a tax, as well as to the City of Paris, of so much per yard.

The employes of this company have no right to enter the sewers, and when any derangement occurs a special branch of the service of the Administration of Telegraph Lines takes charge of the repairs. The functions of the company's linemen cease with running the inside wires on the subscriber's premises, in attaching the apparatus in the designated place, and in carrying the lead-covered double conductor to the sewer, which they open at a convenient place in the ramifications which connect with the houses. When this branch sewer is closed, the linemen of the Administration of Telegraph Lines, after having an understanding with the company's agents, joins up the connecting wires to the two ends entering into the sewer, and then searches for the nearest cable of the company, using one of the double wires which are still spare. As the cable starts from one or the other of the central offices, where it is spread out on one of the *rosaces* in the wire collar, at the sewer opening, the double wire to which the connection with the connecting wire of the subscriber has just been made is easily found on the *rosace*. The name of the subscriber is inscribed thereon, and this wire, continuing through one of the spare switches and annunciators in the office, appropriates for that subscriber the number of that annunciator. The subscriber is thus fully connected, and is first notified that his line is complete by a test made by one of the chiefs of the central office.

The apparatus furnished to the subscribers are the desk transmitters of Ader, and the superexcitation receivers of the same inventor. These instruments generally work very well, and conversation can be carried on perfectly, even between Ivry and the Quarter de L'Europe. Two batteries of three Leclanche cells suffice for this service. One of these batteries is attached to the transmitter, and the two together operate the circuit of the call bell. That for the transmitter is changed every three months, but it would evidently work longer, and that rule was adopted by the company as an excess of precaution. In addition, every morning each subscriber is called by the central office to see if his apparatus works properly—a test which consumes very little time.

As we have mentioned more than once, the frying and pattering noises are frequently heard on the telephone lines of Paris, because the wires of the subscribers have not been completely insulated from the earth. They use a derivation to earth to indicate on the annuntiators the end of a conversation; but, by means of polarized relays, the same result could be obtained without the use of a ground wire, and then the abnormal sounds would become much less. In actual working, the sounds never prevent conversation. Nevertheless, on some days they acquire such a great intensity that conversation cannot be very well understood in certain directions. Most frequently these effects arise from the induction of one wire on another, but also when the current from the battery is too strong and irregular, thus changing the character of the microphonic contacts.

Those who have read the later articles published in this journal, on michrophonic effects, will readily understand the operation of this cause. Sometimes one can hear conversations exchanged on other wires, and nearly always it is sufficient to put one's ear to the telephone, without having called for any connection at the central office, to hear certain fragments of conversations in the central office, the word "hello" being distinguished almost always. Nevertheless, the results that are obtained to-day are very satisfactory, and the organization of the Paris telephone system reflects the greatest honor on Messrs. Lartigne and Berthon, who were charged with it. DE MAGNEVILLE.

(*To be continued.*)

Business Troubles.

The creditors of the Levêt-Müller Electric Light Company, of No. 540 West Sixteenth street, have been agreeably surprised since the publication of the offer of the company to compromise at twenty-five cents on the dollar, to receive word from Alexander Levett, the president, that all debts of the company will be paid in full on presentation at the office. It is said that threatened legal proceedings caused the abandonment of the compromise plan.

An incident in Norwich, Conn., Thursday evening, illustrates an imperfection of our electric fire-alarm system, for which no adequate remedy has been devised. Possibly the proposed new lightning insurance company may be able to meet this peril. A lightning stroke which killed a horse and a dog, and set fire to a barn, so deranged the whole fire-alarm system that no call could be sent out for the firemen until after the building was destroyed.—*Providence Journal.*

May 13 was Authur Sullivan's birthday, when he gave a dinner for twelve at Queen's Mansions, at which assembled the Prince of Wales, the Duke of Edinburgh, the Lord Chamberlain, the Marquis of Hartington, and other distinguished guests. After dinner the guests were presented with telephonic receivers in connection with the Savoy theater, where "Iolanthe," Sullivan's latest operetta, was being given. The choruses and part songs were heard as well in Queen's Mansions as in the theater itself, so perfect was the communication, says "London Life."

Engineering says that during his recent lecture at the Institution of Civil Engineers, Sir William Thompson proposed the term *mho* for a unit of conductivity. Conductivity is the reciprocal of the resistance which is measured in ohms and *mho* is found by saying "ohm" into a phonograph, and then turning the drum backward. How Sir William finds the reciprocal of a value equivalent to a word spoken backward he does not explain, and, on the whole, we think he has chosen a somewhat fanciful way of finding a new electric term. Nevertheless, a convenient unit word for conductivity would be useful.

We may add that in Sir William's opinion electricians may safely take the British Association unit of resistance as 0.9868 of the true ohm defined at 10° centimeters per second, or the Siemens unit as 0.9413 of theohm.

Mr. J. E. Smith, the Superintendent of Telegraph of the Fire Department, this city, has invented an instrument which, with a weak current of electricity, will sound all ambulance calls and calls for the insurance patrol on the fire wires, so that such alarms need not be sounded on all the department gongs and the men and horses will not be called out unnecessarily.

A resolution passed by the Fire Commissioners, June 8, permits Superintendent Smith to place his instruments in hospitals and in the quarters of the Fire Insurance Patrol. About 300 ambulance and Fire Insurance Patrol calls are sent over the fire wires every year.

On the Electrolysis of Binary and Various Other Acids and Saline Compounds with Electrodes of Carbon.

BY A. BARTALI AND G. PAPASOGLI.

In all cases where no oxygen is evolved at a positive electrode of retort-coke, wood-charcoal, or graphite, it does not become disaggregated and undergoes no notable loss in weight, *e. g.*, in the electrolysis of concentrated hydrochloric and hydrobromic acids, or solutions of bromide or iodide of potassium.

If oxygen is evolved at the positive electrode, as in the electrolysis of dilute solutions of the above mentioned salts and acids, solutions of arsenious acid of various degrees of concentration, cold concentrated solution of boric acid, dilute sulphuric acid, sulphates, oxalates and formiates, strong solutions of hypochlorites, permanganates, bichromates, alkaline chlorates, nitric acid, pyrogallic acid (although it eagerly absorbs oxygen), a positive electrode of coke or wood-charcoal is disintegrated and the liquid takes a deep-brown color with formation of mellogen. In solution of sodium sulphate this does not occur. A positive electrode of graphite yields graphite acid, but the solution is not colored.

In strong solutions of hydrofluoric acid a positive electrode of coke is scantily disaggregated, but becomes brittle; little hydrogen is liberated at the negative pole. After some time the positive electrode, if powdered and washed for some time, still retains hydrogen, oxygen, and fluorine. A positive electrode of graphite quickly crumbles away, and the powder formed retains fluorine even after prolonged washing. In solutions of potassium antimoniate a positive electrode of gas-coke or wood-charcoal quickly wears away; the solution becomes black and deposits a precipitate soluble in water. After filtration and concentration hydrochloric acid gives a precipitate, containing carbon, hydrogen, oxygen, and antimony, and is named stibio-mellogen. Graphite is disintegrated and yields a black powder consisting of graphite and a new antimoniferous compound.

Electric Illumination of the City of Rio Janeiro.

(From the *Monitor Campista*, Campos, Brazil, S. A., May 5th.)

Yesterday there was made another trial on four electric lamp posts [Brush system,] two erected in the Praca Principal, and two in the Rua de D. Pedro II, at the entrance to Rua do Ouvidor and Rua do Quitanda.

The effect was really splendid in the Praca, and excellent in the Beira-Rio. In the Praca the brightness exceeded that of the clearest moonlight, and the light was so soft that it was agreeable to the sight.

It is possible to put up many foci, the first trial had thirty-nine without lamps, without causing the least inconvenience to the eyes, or dazzling them.

Colors are not affected, and only a slight touch of paleness is noted in the faces, without prejudice to the beauty of the ladies.

There was an extraordinary attendance of people in the localities of the trial, and the station was open to families who could appreciate the running of the machinery.

The result, then, of this new trial has been decisive for the people, and satisfactory for the company.

We know that Messrs. Alves Carvelho & Oliveira have done everything for a good distribution of light, to which the irregularity of the streets opposes a great difficulty, and that for six months they have studied the arrangement of the streets with the greatest case, it appearing to them at last that they could attain a satisfactory result illuminating with all possible uniformity and advantage the commercial and most frequented streets throughout the heart of the city.

It is certain that they are not drawing back from the pecuniary sacrifices, which

will be most heavy because of the inexperience which still exists in this service in our country.

For Campos the practicability of this important undertaking is beyond doubt, and the glory of having initiated so admirable an improvement can now be no longer contested.

The foci were in operation from half-past six o'clock up to a quarter before eleven. It is necessary to say that not only were the foci of the street in operation but also thirty-eight in the station, these without lamps producing nevertheless a brightness there superior to that of day.

Probably the inauguration of the illumination of all the city will be made this month. The erection of the posts and the stretching of the wires of the electric circuit are being actively effected.

The posts are from 45 to 50 *palmos* [30 to 33½ feet] in height, octagonal, sustaining a lamp on an iron brace fixed at the top, which presents an elegant appearance to the sight.

It is with the greatest joy that we repeat the congratulations to Campos and our felicitations to the Campista company of the Brush system of electric light.

Mr. Peter Kurczyn, agent of the Brush Electric Light Company in Rio de Janeiro, attended the trial, who, as we have already noticed, came from the capital for that purpose.

Accumulators and Metallodion.

Engineering, London, says: Dr. H. Aron, of Berlin, who is well known for his investigations of secondary batteries, has enriched scientific phraseology with the somewhat peculiar term of metallodion, by which he denotes a mixture of any metallic oxide with collodion, the solution of gun-cotton in a mixture of alcohol and ether which is so largely used in photography. Dr. Aaron's experiments commenced in the year 1880, when it appears that he, before the proposals of M. Faure became known, used plates consisting of spongy lead, which, however, he found in subsequent experiments suitable only as negative electrodes, the formation of suboxide of lead at the positive electrode probably diminishing the conductivity of the battery. Dr. Aron proposed, it is stated, the use of minium, and once even asked his assistant to prepare a minium plate; he did not carry out the idea, as he considered it impossible to fasten the minium properly to its plate. Later on, however, he prepared a lead plate with a coat of minium and collodion made into a paste, and proceeding on these lines he obtained some interesting results. Metallodion seems to admit of further useful application. If the carbon of a Leclanche cell is brushed over with a paste of pyrolusite and collodion, the carbon rod needs no further adjustment, and may directly be placed with the zinc in the vessel containing the solution of chloride of ammonium without requiring a special porous cell. Dr. Aron further observed that to impart to the lead plate the necessary crystalline structure, it need not be placed in nitric acid previous to its further preparation, it will be sufficient to use a mixture of sulphuric acid with a little nitric acid in the battery, or, better still, to employ at first pure sulphuric acid, and then, after the lead has become covered with a thin coating of peroxide, to add the nitric acid, when this peroxide, being practically impenetrable to nitric acid, will prevent any too energetic action. Plates may thus be prepared to the depth of one-half millimeter much more quickly than under ordinary circumstances, and they readily acquire a good charge, but they do not appear to be able to hold this charge so long as a Faure or metallodion battery.

New Electrical Commutator.

M. E. Renoult has devised a new key for putting an electrical appliance in circuit, or withdrawing it, without interrupting the current. It consists of two copper plates, insulated by a block of wood, to which they are attached. The main leads are attached by binding screws or otherwise, to the copper plates at one end, while the other is left free, in the form of a fork, capable of being readily attached to two other copper plates insulated from each other and connected with the leading wires, which put the appliance in circuit. To break contact with these two last-named leads, the fork is withdrawn, while at the same time the circuit is closed by means of a screw carrying on its axis a movable metal plate. In this way the continuity of the current is maintained, while the original resistance is re-established.

Influence of Tempering on the Electrical Resistance of Glass.

M. Jamin lately brought before the Académie des Sciences, Paris, some observations made by M. Foussereau on the influence exercised by the process of tempering on the electrical resistance of glass. The experiments made by this gentleman lead him to the following conclusions: 1. Tempering diminishes, in a considerable degree, the electrical resistance of different varieties of glass. 2. A moderate annealing, sufficient to partially dispel the elasticity due to tempering, diminishes only in a partial degree the influence of tempering on the electrical resistance. 3. The electrical resistance of glass recently annealed continues to increase slowly during a certain period, as if its molecules gradually approached a condition of definite equilibrium; and the electrical resistance of glass, whether tempered or not, which has not been lately heated, remains constant.

New Experiments in Electrolysis.

In a recent number of the *Comptes Rendus* M. E. Semmola describes a new experiment in electrolysis. The apparatus consists of a voltameter having three electrodes arranged in the form of an equilateral triangle, with a tube over each electrode. One of the electrodes, *c*, is connected with the positive pole of the battery, the other two, *a* and *b*, being connected with the negative pole by means of a commutator, which is so arranged that the current can be sent entirely through *a* or *b*, or can be separated and sent partly through *a* and partly through *b*. The sum of the volumes of hydrogen collected in the two tubes when the current is thus separated, is equal to the volume collected in a single tube when the current is sent entirely through one of the electrodes *a* and *b*, thus proving by means of a single voltameter that the same quantity of electricity always produces the same amount of chemical decomposition.

Hartford Wants the Whole Loaf.

HARTFORD, June 11.—Now that they have the arc lights under good headway, some four public-spirited citizens want to try the incandescent system. As an outcome of a little talk that has been "floating" lately, Mr. F. S. Hastings, treasurer of the Edison company, met several business men on Friday evening last, and talked the matter over with them in a common-sense, practical way. He explained in brief the advantages this system of lighting possesses over gas, as regards economy, safety, and convenience, and gave some practical results of its workings in New York and elsewhere.

Making a rough estimate, Mr. Hastings said his company could put in a plant here of about 4,800 ten-candle lamps, including every item of expense, excepting real estate, for the necessary buildings, for about seventy thousand dollars. Instead of making any profit on the dynamos, lamps, and other paraphernalia, they would sell them at actual cost, and instead take twenty-five thousand dollars in paid-up stock of the company. And then, here, as elsewhere, they should ask an annual royalty of two dollars per horse-power, to enable Mr. Edison to continue his experiments.

The meeting was a very profitable and entertaining one, and Mr. Hastings made a good impression. This action was taken to get the matter thoroughly before the public, and where so much interest is manifest some definite results may be looked for. Mr. Hastings said he would send up an expert to get statistics and make surveys, and he could then give us accurate information of the precise cost of putting in a plant. The present arc-lighting company seem disposed to help start the new one, as far as in their power. Possibly the strong opposition shown by the gas company this spring may have made them a little revengeful.

The Electromotive Force of Batteries.

Recent experiments by Mr. W. H. Preece, F. R. S., communicated to the Royal Society, show that changes of temperature do not practically affect the electromotive force of a battery, but they materially affect the internal resistance. Faraday's observation that the improved current from a heated cell is due to increased conductivity is thus confirmed. Mr. Preece's results also show that of the various forms of batteries in practical use the Daniell is most seriously influenced by variations in temperature, and that in all experiments with that battery either the temperature must be kept constant or frequent measurements should be taken of the internal resistance of the battery and allowance made for the variation. Elaborate curves of variation with temperature in Daniell, bichromate and Leclanche cells, together with corresponding tables, are given in Mr. Preece's paper. The laborious observations have been made by Mr. Shida. The electromotive forces and resistances of the batteries were measured by the discharge test.

The Cause of Evident Magnetism in Iron, Steel and other Magnetic Metals.

PAPER READ BEFORE THE SOCIETY OF TELEGRAPH ENGINEERS AND OF ELECTRICIANS, LONDON, BY PROF. D. E. HUGHES, F. R. S., VICE-PRESIDENT, MAY 24, 1883.

ROTATION OF INHERENT POLARIZED MOLECULES.

Torsion, as well as mechanical vibrations, has, as we have seen, a powerful influence in aiding the molecules to overcome their inertia, and thus aid them to rotate in the direction of the inducing influence; and we may thus polarize strongly a flat soft iron rod by simply bending or vibrating it when held vertically, and if we measure the magnetic force obtained we shall notice that the force is strictly relative to the degree of softness of the iron. Thus, with hard steel we should obtain only *traces* of polarization, whilst with extremely pure soft Swedish iron we obtain the maximum of force. The bar of iron or steel, being held in the earth's magnetic field, of infinite size compared with the bar, and infinitely homogeneous, cannot deflect or weaken its surrounding field. Its lower portion being north, apparently strengthens it by its reaction, whilst its upper, south, apparently weakens the field; but, as Maxwell has shown, "the two poles of each molecule are equal and opposite, consequently the sum of each molecule and the whole mass must be zero."

We have a far greater induced polarity in iron or steel when the iron is in thin bars or small wires, and this we should expect, as the external molecules rotate directly under the influence of the earth's magnetism, whilst those forming the interior of the bar either rotate feebly, or, as in the case of very thick bars, actually act as an armature, preventing, by their influence, free rotation of the exterior molecules.

Thus, as the sum of the two and equal polarities in a bar of iron is zero, it is evident that its polarity must be inherent. I have some remarkably pure soft Swedish iron wire, one millimeter in diameter, and as its inherent polar force seemed great when held vertically in the earth's magnetic field, I measured in the induction balance this force compared with a similar column of the magnetic atmosphere which it displaced. The inherent polarity of this wire, simply rendered evident by the earth's magnetism, was 15,600 times greater than the column it displaced.

We cannot, either by induction, conduction, or concentration, produce a greater force in another body of similar displacement or size, otherwise we could easily create power from a feeble source. Thus the enormously greater magnetic power observed in iron than the same column of air which it displaces must be due to the *inherent* polarity of its molecules.

Amongst numerous bars of iron upon which I have experimented, one of ordinary hoop-iron, 2 centimeters wide, 40 centimeters long, and 1½ millimeter thick, not softened, possesses sufficient molecular rigidity to be apparently uninfluenced by earth's magnetism. When this rod is rendered neutral, we have but feeble polarity—mere traces when it is held vertically under the earth's magnetic influence; but if we apply a few successive torsions or vibrations to it when thus held, we have at once several thousand times greater polarity than before. Now, if iron had the power of deflecting or concentrating the earth's magnetism upon itself, it should not require the mechanical aid to molecular rotation given to it by those torsions or vibrations. Thus we are forced to conclude at least the existence of the inherent polarity of the molecules; and, if we admit this, we must also, as a necessary consequence, admit the rotation of these molecules, else we cannot explain why mechanical vibrations allowing freedom of motion should always produce the polarity in accordance with the directing cause. I have already shown that torsion and vibrations *per se* are apparently destructive of magnetism; consequently in this case Poisson's two fluids and Ampère's parallel currents should, according to their theory, be mixed or heterogeneous, whilst according to the views I am sustaining the polarized molecules should obey, as compass needles, any magnetic directing cause whenever sufficient molecular freedom of motion allows free rotation.

The inherent polarity of iron may again be observed by drawing a flat rod of soft iron over one or both poles of a permanent magnet. This rod will then be powerfully magnetized, its remaining magnetism, when separated from the magnet, being sufficiently powerful to strongly deflect a suspended direction needle. A few slight torsions or vibrations will then completely discharge it. Now, suppose this operation repeated successively many thousand times, if there was no inherent polarity we should have gradually drawn all the polarity ont of the magnet, and discharged it into the atmosphere. Nothing of the kind takes place. The molecules of the iron are simply rotated each time, and the only energy in work expended or lost comes from the arm of the experimenter, and the energy required would be strictly in accordance with the molecular freedom, or softness and hardness of the iron and steel: thus, whilst soft iron could be easily polarized and discharged by mechanical torsions, hard-tempered steel would require a far greater amount.

Dr. Warren de la Rue, F. R. S., kindly aided me in this part of the research by passing a current from his well-known chloride of silver battery through iron and steel wires. A condenser of 42.8 microfarad capacity, charged by 3.360 cells, was used. We passed this enormous electric charge longitudinally through the wires, and observations were made as to whether any change whatever was produced in their quality or inherent polarity, the result being that these wires gave exactly the same magnetic polarity from a given directing or inducing cause as before, being similar in nature and degree, consequently this enormous electric force had not changed or destroyed the original inherent polarity.

If the molecules possess inherent polarity and rotate upon their axis, similar to a series of compass needles having a slight degree of frictional rigidity, then, upon passing one pole of a magnet above them, they would turn symmetrically in one direction, and drawing the same pole of the magnet in the contrary direction would rotate them, and they would then remain symmetrically in the opposite direction.

A precisely similar effect takes place in a soft iron rod, placed east and west a few inches above a direction needle. Upon drawing the south pole of a powerful natural

magnet at a few centimeters distance above the wire from east to west, the north polarities of the molecules successively turn in the direction of west, following the attraction of the south pole, as previously seen on the small compass needles. The rod is now magnetized with its north pole west, as indicated by the direction needle below any portion of this rod. Upon passing the same south pole of the natural magnet in a contrary direction, the molecules all rotate, their north poles still turning successively to the the south pole of the permanent magnet until its arrival at the end from which the first magnetization commenced. The rod has now entirely changed its polarity, and its north pole is east.

This phenomenon is well known in the ordinary magnetization of rods, where care is taken to draw the magnet always in a similar direction, or the poles would be reversed at each to and fro drawing. To account for this, on Coulomb-Poisson's theory, it would be requisite that, first, all the fluids be separated with their north fluids symmetrically in one direction, but on drawing back the magnet, these fluids would have to mix together, the north fluid passing through its south fluid to be finally opposite to its previous position, its coercive force doing the double work of allowing both fluids to mix and pass through each other, and finally keeping them entirely apart. Ampère's theory would require that from a hap-hazard arrangement the molecules should become symmetrically arranged upon the first passage of the magnet, then upon its reversed direction one-half of the electric elementary currents should successively revolve in a contrary direction to arrive at neutrality before, finally, the other half followed the direction of the first half, and now all these currents would be revolving in the opposite direction to that upon the first magnetization. We thus see that both these theories, whilst resting altogether upon assumption, are extremely complicated and improbable.

We might suppose, from the theory which I am advocating, that upon the rotation of the molecules there would be some disturbance or mechanical trepidation; and such is found to be the case, as first observed by Page, and afterwards verified by Dr. Joule and De la Rive, in the molecular sounds produced in iron upon its magnetization. Reis's first telephone was founded upon these sounds, and Du Moncel has made numerous researches upon this subject.

In the last of my experiments cited, the sounds are too feeble to be heard, but by the application of the microphone these trepidations at once become audible.

That molecules of iron and other metals rotate with time, whose period becomes shortened by mechanical vibrations, is well known in metallurgy, the ultimate result being generally the passage from a fibrous condition, as in iron wires, to a high degree of crystallization. For many years I employed a circular vibrating spring as the regulator of speed of my printing telegraph instrument, and although this spring was so regulated by means of a frictional break, or "Frein," as not to surpass its limits of elasticity, these springs were constantly breaking after a few days use, and, as a matter of urgent necessity, I made special researches into the cause of this breaking after a few days constant vibratory action. I found at the point of rupture a high state of crystallization. Fibrous iron would thus become thoroughly crystallized and break in one day; the number of vibrations for an instrument in constant use during twenty-four hours being 1,209,600. Thus we could roughly estimate the life of iron in the form of one of these springs at one million vibrations. Copper crystallized in one hour, and all metals and alloys were inferior to steel, except aluminium bronze. The latter springs would stand six weeks' constant use, or some fifty millions of vibrations. I finally resolved this problem by spreading the amount of vibrating work over a spiral spring containing three meters of steel rod wound into the same space as previously held by the straight rod of thirty centimeters; by this means the average life of these springs has become five years. Evidently the molecules of these fibrous springs must have rotated under the vibrations, in order to produce crystals. The same phenomenon is observed in axles of carriages receiving constant trepidations, large crystals being always found at the point of fracture. Again, if we rapidly magnetize and demagnetize an iron rod, we have the production of evident heat, due to the constant motion of its molecules.

Maxwell describes an experiment of Beetz, in which an exceedingly small filament of iron was deposited by electrotype, under the influence of a strong magnetic field, in order to arrive at the inherent polarity of comparatively few molecules, and, as its magnetic force was very great, he regards the experiment as conclusive. My own experiments show that we have far less external magnetic force from a solid bar than from a thin tube or flat bar of the same surface exposed to a limited exciting cause. We know that magnetism does not penetrate to a very great depth, and we also know that, if to a thin steel permanent magnet we place another piece unmagnetized, or, better still, a rod of soft iron, its external polarity is greatly reduced; consequently the external evidence of polarity is not a direct measure of the degree of rotation, nor of the total inherent polarity of its mass. We may have a great superficial *external* rotation superposed upon rotations of an opposite nature, as will be seen later; and thus the internal molecules of a magnet often act more or less as an external armature in closing its circle of attractions.

I have stated my belief that the molecule itself possesses its inherent polarity, which, like gravity, is an endowed quality for which we have no more reason to suspect the cause to be elementary electric currents than that elementary currents should be the cause of gravity, chemical affinity, or cohesion and its polar power of crystallization, most of which are affected by an electric current. We have a certain analogy between electric currents and magnetism, but not so great as the analogy between the magnetic polarity of a molecule and its other endowed qualities.

Magnetism, like chemical affinity, cohesion, and crystallization, has its critical points. Faraday discovered that at red-yellow heat iron instantly lost its apparent polar magnetic power, to be as instantly restored at red heat, the critical point varying in iron, steel, &c., and being the lowest in nickel. This would be difficult to explain upon Ampère's theory, as we should have to admit the instant destruction or cessation of the elementary currents, to be again restored at a few degrees less temperature. It would be equally difficult to explain under my view, if it did not belong to a whole class of phenomena due to the possession by the molecules of various endowed qualities, of which chemistry and all our means of research can only teach us their critical points, without attempting to explain why, for instance, iron has a greater affinity for oxygen than gold. We know that it is so; we know that the molecules of all matter are endowed with certain qualities having certain critical points, and I can see no reason for separating their magnetic inherent polarity from their numerous other qualities.

NEUTRALITY.

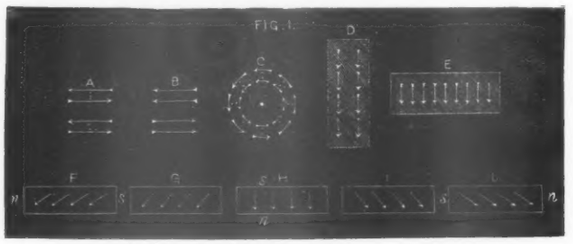
The apparatus needed for researches upon evident external polarity requires no very great skill or thought, but simply an apparatus to measure correctly the force of the evident repulsion or attraction; in the case of neutrality, however, the external polarity disappears, and we consequently require special apparatus, together with the utmost care and reflection in its use.

From numerous researches previously made, by means of the induction balance, the results of which I have already published, I felt convinced that investigating the cause of magnetism and neutrality I should have in it the aid of the most powerful instrument of research ever brought to bear upon the molecular construction of iron, as indeed of all metals. It neglects all forces which do not produce a change in the molecular structure, and enables us to penetrate at once to the interior of a magnet or piece of iron, observing only its peculiar structure and the change which takes place during magnetization or apparent neutrality.

The induction balance is affected by three distinct arrangements of molecular structure in iron and steel, by means of which we have apparent external neutrality.

Fig. 1 shows several polar directions of the molecules, as indicated by the arrows. Poisson assumed, as a necessity of his theory, that a molecule is spherical, but Dr. Joule's experimental proof of the elongation of iron by $\frac{1}{160000}$ of its length, when magnetized, proves, at least, that its form is not spherical; and, as I am unable at present to demonstrate my own views as to its exact form, I have simply indicated its polar direction by arrows—the dotted oval lines merely indicating its limits of free elastic rotation.

In Fig. 1, at *A* we have neutrality by the mutual attraction of each pair of molecules, being the shortest path in which they could satisfy their mutual attractions. At *B* we have the case of superposed magnetism of equal external value, rendering the wire or



rod apparently neutral, although a lower series of molecules are rotated in the opposite direction to the upper series, giving to the rod opposite and equal polarities. At *C* we have the molecules arranged in a circular chain around the axis of a wire or rod through which an electric current has passed. At *D* we have the evident polarity induced by the earth's directive influence when a soft iron rod is held in the magnetic meridian. At *E* we have a longitudinal neutrality produced in the same rod when placed magnetic west, the polarity in the latter case being transversal.

In all these cases we have a perfectly symmetrical arrangement, and I have not yet found a single case in well-annealed soft iron in which I could detect a heterogeneous arrangement, as supposed by Ampere, De la Rive, Weber, Wiedermann and Maxwell. We can only study neutrality with perfectly soft Swedish iron. Hard iron and steel retain previous magnetizations, and an apparent external neutrality would in most cases be the superposition of one magnetism upon another of equal external force in the opposite direction, as shown at *B*, Fig. 1.

Perfectly soft iron we can easily free by vibrations from the slightest trace of previous magnetism and study the neutrality produced under varying conditions.

If we take a flat bar of soft iron of 30 or more centimeters in length, and hold it vertically (giving while thus held a few torsions, vibrations, or better still, a few slight blows with a wooden mallet in order to allow its molecules to rotate with perfect freedom), we find its lower end to be of strong north polarity and its upper end south. On reversing the rod and repeating the vibrations we find that its lower end has precisely a similar north polarity. Thus the iron is homogeneous and its polarity symmetrical. If we now magnetize this rod to produce a strong south pole at its lower portion, we can gradually reverse this polarity, by the influence of earth's magnetism, by slightly tapping the upper extremity with a small wooden mallet.

If we observe this rod by means of a direction needle at all parts, and successively during its gradual passage from one polarity to the other, there will be no sudden break into a hap-hazard arrangement, but a gradual and perfectly symmetrical rotation from one direction to that of the opposite polarity.

If this rod is placed east and west, having first, say a north polarity to the right, we can gradually discharge or rotate the molecules to zero, and as gradually reverse the polarity by simply inclining the rod so as to be slightly influenced by earth's magnetism, and at no portion of this passage from one polarity to neutrality, and to that of the opposite name, will there be found a break of continuity of rotation or hap-hazard arrangement.

If we rotate this rod slowly, horizontally or vertically, taking observations at each few degrees of rotation of an entire revolution, we find still the same gradual symmetrical change of polarity, and that its symmetry is as complete at neutrality as in evident polarity. In all these cases there is no complete neutrality, the longitudinal polarity simply becoming transversal when the rod is east and west.

F, G, H, I, J, Fig. 1, show this gradual change, *H* being neutral longitudinally, but polarized transversly.

If, in place of the rod, we take a small square soft iron plate and allow its molecules freedom under the sole influence of the earth's magnetism, then we inavariably find the polarity in the direction of the magnetic dip, no matter in what position it be held, and a sphere of soft iron could only be polarized in a similar direction.

Thus we can never obtain complete external neutrality while the molecules have freedom and do not form an internal closed circle of mutual attractions; and whatever theory we may adopt as to the cause of polarity in the molecule, such as Coulomb's, Poisson's, Ampere's or Weber's, there can exist no hap-hazard arrangement in perfectly soft iron, as long as it is free from all external causes except the influence of the earth; consequently these theories are wrong in one of their most essential parts.

We can, however, produce a closed circle of mutual attraction in iron and steel, producing complete neutrality as long as the structure is not destroyed by some stonger external directing influence.

Oersted discovered that an external magnetic needle places itself perpendicular to an electric current; and we should expect that, if the molecules of an iron wire possessed inherent polarity and could rotate, a similar effect would take place in the interior of the wire to that observed by Oersted. Wiedermann first remarked this effect, and it has been known as circular magnetism. This circle, however, consists really in each molecule having placed itself perpendicular to the current, simply obeying Oersted's law, and thus forming a complete circle, in which the mutual attractions of the molecules forming that circle are satisfied, as shown at *C*, Fig 1.

This wire becomes completely neutral, any previous symmetrical arrangement of polarity rotating to form its complete circle of attractions; and we can thus form in hard iron and steel a neutrality extremely difficult to break up or destroy. We have evident proof that this neutrality consists of a closed chain or circle, as by torsion we can partially deflect them on either side, thus, from a perfectly neutral wire, producing either polarity, by simple mechanical angular displacement of the molecules, as by right or left-handed torsion.

If we magnetize a wire placed east and west, it will retain this polarity until freed by vibrations, as already remarked. If we pass an electric current through this magnetized wire, we can notice the gradual rotation of the molecules and the formation of the circular neutrality. If we commence

with a weak current, gradually increasing its strength, we can rotate them as slowly as may be desired. There is no sudden break or hap-hazard moment of neutrality. The movements to perfect zero are accomplished with perfect symmetry throughout.

We can produce a more perfect and shorter circle of attractions by the superposition of magnetism, as at *B*, Fig. 1. If we magnetize a piece of steel or iron in a given direction with a strong magnetic directing power, the magnetism penetrates to a certain depth. If we slightly diminish the magnetizing power, and magnetize the rod in a contrary direction, we may reduce it to zero by the superposition of an exterior magnetism upon one of a contrary name existing at a greater depth; and if we continue this operation, gradually diminishing the force at each reversal, we can easily superpose ten or more distinct symmetrical arrangements, and, as their mutual attractions are satisfied in a shorter circle than in that produced by electricity, it is extremely difficult to destroy this formation when once produced.

The induction balance affords also some reasons for believing that the molecules not only form a closed circle of attractions, as at *B*, but that they can mutually react upon each other, so as to close a circle of attractions as a double molecule, as shown at *A*. The experimental evidence, however, is not sufficient to dwell on this point, as the neutrality obtained by superposition is somewhat similar in its external effects.

We can produce a perfectly symmetrical closed circuit of attractions of the nature of the neutrality of *C*. Fig. 6, by forming a steel wire into a closed circle, ten centimeters in diameter, if this wire is well joined at its extremities by twisting and soldering. We can then magnetize this ring by slowly revolving it at the extremity of one pole of a strong permanent magnet; and, to avoid consequent poles at the part last touching the magnet, we should have a graduating wedge of wood, so that whilst revolving it may be gradually removed to greater distance. This wire will then contain no consequent points or external magnetism; it will be found perfectly neutral in all parts of its closed circle. Its neutrality is similar to *C*, Fig. 6; for if we cut this wire at any point we find extremely strong magnetic polarity, being magnetized by this method to saturation, and having retained (which it will indefinitely) its circle of attractions complete.

I have already shown that soft iron, when its molecules are allowed perfect freedom by vibration, invariably takes the polarity of the external directing influence, such as that of the earth, and it does so even with greater freedom under the influence of heat. Manufacturers of electro-magnets for telegraphic instruments are very careful to choose the softest iron and thoroughly anneal it; but very few recognize the importance as regards the position of the iron whilst annealing it under the earth's directing influence. The fact, however, has long since been observed.

Dr. Hooke in 1684 remarked that steel or iron was magnetized when heated to redness and placed in the magnetic meridian.

I have slightly varied this experiment by heating to redness three similar steel bars, two of which had been previously magnetized to saturation and placed separately with contrary polarity as regards each other, the third being neutral. Upon cooling, these three bars were found to have indentical and similar polarity.

Thus the molecules of this most rigid material, cast steel, had become free at red heat and rotated under the earth's magnetic influence, giving exactly the same force on each; consequently the previous magnetization of two of these bars had neither augmented nor weakened the inherent polarity of their molecules.

Soft iron gave under these conditions by far the greatest force, its inherent polarity being greater than that of steel.

I have made numerous other experiments bearing upon the question of neutrality, but they all confirm those I have cited, which I consider afford ample evidence of the symmetrical arrangement of neutrality.

SUPERPOSED MAGNETISM.

Knowing that by torsion we can rotate or diminish magnetism, I was anxious to obtain by its means a complete rotation from north polarity to neutrality, and from neutrality to south polarity, or to completely reverse magnetic polarity by a slight right or left torsion.

I have succeeded in doing this, and in obtaining strong reversal of polarities, by superposing one polarity given while the rod is under a right elastic torsion, with another of the opposite polarity given under a left elastic torsion, the neutral point then being reached when the rod is free from torsion.

The rod should be very strongly magnetized under its first or right-hand torsion, so that its interior molecules are rotated, or in other words, magnetized to saturation; the second magnetization in the contrary sense and torsion should be feebler, so as only to magnetize the surface, or not more than one-half its depth; these can be easily adjusted to each other so as to form a complete polar balance of force, producing, when the rod is free from torsion, the neutrality as shown at *B*, Fig. 1

Primary Batteries.

The probability that a highly efficient and original form of secondary battery would be of considerable commercial value has for the last year or two thrown the current of invention strongly in this direction, whilst primary batteries have been comparatively neglected. It is true that a certain amount of work in the direction of improving primary batteries has been done, but the results have commanded but little, if any, attention. As a source of power either for electric light or electromotive purposes, the primary battery cannot at present hope to play an important part, though we could not venture to assert that in the future it will not prove an economical source of electricity. Undoubtedly very great advances require to be made, but that they cannot be made it would be unsafe to predict.

For telegraphic purposes we think primary batteries will prove indispensable for a long time to come, and there is a considerable field for improvement in this direction. Telegraph batteries are still a long way from perfect; they are decidedly wasteful, and give far more trouble than they ought. For constancy the Daniell has never been equaled; it will stand the heaviest work without any tendency to exhaustion, and, in fact, the more heavily it is worked the more economical does it become. A Daniell battery when lightly worked consumes a very great portion of its active material in local action, and when not worked at all in a very short time it exhausts itself, and its cells become choked with a mass of decomposed chemicals. The Leclanché is a contrast to the Daniell as regards cleanliness, yet it is by no means perfect in this respect; the phenomenon known as "creeping" has never been wholly eliminated in the Leclanché, at least in those forms of the element which are not hermetically sealed up. This "creeping" is a most annoying source of deterioration in all batteries, and nothing seems capable of effectually eradicating it. But the Leclanché, in spite of its many excellent qualities, is useless for producing powerful and constant currents for a lengthened period.

For telegraph purposes the bichromate battery of Mr. J. Fuller is now being very extensively used, and in spite of the many assertions that it cannot be considered to be a new invention, it possesses sufficient points of novelty to come under the latter category. The bichromate battery as originally constructed did not answer for telegraphic purposes; the bichromate battery as arranged by Mr. Fuller proves to be highly efficient and useful; this fact, one would think, is sufficient to make it a novelty. The bichromate is, however, by no means free from local action, and the smaller the resistance of its porous cell the greater is the local action that takes place when the battery is not comparatively heavily worked. A battery is like a very leaky cistern—if you draw off the water quickly you will lose very little of it, but if you draw it off slowly a large amount will be lost by leakage. The most powerful batteries are decidedly very leaky, but how to get rid of the leaks is a problem which no one has yet been able to solve satisfactorily. The liability of the zinc in a battery to dissolve unequally has recently been much reduced, if not entirely avoided, by a novel invention, patented by Messrs. Burr and Scott. These gentlemen very thinly *gild* the surface of the zinc element and then coat the gold with a film of mercury; this process almost entirely gets rid of the local action which usually disintegrates the zincs. It is difficult to understand the part which the gilding plays, but that it is effectual is, we believe, unquestionable. In telegraphy, as we have said, there is an undoubted field for workers in the direction of batteries; there is also a field in the domain of electric power; but the difficulties to be overcome in this direction are very much greater than in the case of telegraphy, as the economical view of the question has very great weight. Primary batteries, however, would, in many cases where temporary electric light installations at a short notice are required, prove very useful.—*London Electrical Review.*

Secondary Batteries and the Electrical Storage of Power.

At the Society of Arts in London, May 28th, Prof. Oliver J. Lodge, M. A., D. Sc., delivered the first of two lectures on the above subject. Dr. Mann presided, and introduced the lecturer.

Prof. Lodge said the methods of storing energy were very numerous. They might store it mechanically or they might store it chemically. He had put down on the syllabus "electrical methods of storing energy," but, as a matter of fact, he thought they might resolve all apparently electrical methods into either mechanical or chemical; at any rate, into electro-mechanical or electro-chemical. After giving several illustrations of the storage of energy by both mechanical and chemical processes, the lecturer described the general principles of secondary batteries, and in regard to the plates said that what they wanted was a plate to hold the oxygen and become oxidized. Lead forms an insoluble oxide, and was consequently suitable for the purpose. A few others were insoluble, but lead had the advantage. It was better than either silver or manganese for the reason that its oxide was less soluble. They had the plate gradually eaten into by the oxygen, hence the storage of a large quantity of energy. What became of the hydrogen? Did the lead plate absorb the hydrogen? He thought it did to some extent, and that the lead became hydrogenzied. Dr. Frankland said it did not.

Dr. Frankland was most likely right, but on the hypothesis that the lead absorbed no hydrogen, and that the lead was lead pure and simple, he could not understand how he obtained certain results by certain experiments. He must there say a word about the positive and negative plates. Some people called the one plate positive and the other negative, and others *vice versa*. The matter was simple. If one decided to call that the positive plate by which the current entered and from which the discharged current left, they were not to call it sometimes the positive and sometimes the negative; the positive when charged and the negative when discharged, that led one into intolerable confusion. Supposing (experimenting with a small cell) he took away the negative or hydrogen plate and replaced it by a bit of clean lead, according to Dr. Frankland the negative plate did not differ from clean lead—it absorbed no hydrogen—it was nearly exhausted—it gave a current for only a second or two. To prove that it was not the positive plate which was exhausted he should remove the clean lead and put in an old piece of lead which had not replenished itself. It showed more strength, and so he thought the plate in that respect must differ from ordinary lead, and how it differed he could not understand, except in consequence of the hydrogen. When the cell itself ran down, which, he would ask, was the first to fail? Did the negative plate fail first and become exhausted of its hydrogen, or did the positive plate become deoxidized, or did they both fail together? He tried that experiment by immersing the plates a little bit in the liquid and letting that little bit of each exhaust itself, and then introducing a little more of the plates and seeing which caused the current to renew itself. He stopped the charging current; he raised the plates, immersing only about a quarter of an inch of each, and then discharged them. He discharged them by putting in the galvanometer and the bell (attached to the cell with which he was experimenting), and they would hear that the bell and see that the galvanometer were weak. Now, that (pointing to the positive plate) was exhausted. If he let it stand it would recover itself in a little; if they let it stand a short time it would give a current for a short time; if they let it stand a longer time it would give a current for a longer time. Now, having exhausted it, let him dip the positive plate a little deeper in, bringing a new surface of positive plate to bear. That did not do much good. Let him bring a new surface of negative plate to bear (showing more energy). It was that which was exhausted. The tip of the negative plate was exhausted before the tip of the positive plate, and therefore he must have a fresh negative. The positive would go on much longer than the negative. He would charge up again. Now, that (pointing) was the form of the secondary battery until the time of Planté. The improvement of Planté consisted in not only giving an oxidizable plate but a reduciable plate, and he got his reducible plate simply by reversing the cell. If they reversed the charging battery they would then make the peroxidized plate the negative. The other plate became the positive. So by perpetual reversals Plante managed to get the plates into a thoroughly porous or spongy condition for some depth. The modification which Faure introduced into the Plante cell was to get the reducile plate without those great number of reversals. Plante coated the plate before proceeding to charge it with minium or red lead—an imperfect and non-conducting oxide, a porous substance through which the current would penetrate. The oxygen was liberated on the surface of the lead plate, which again became peroxidized, but the peroxidization went into the lead plate, and spread out until all was peroxidized or coated, and when that happened gas began to give off. Until that happened nearly all the gas was absorbed. If they coated the negative plate with the same kind of stuff, they had a reducible plate practically. The hydrogen liberated on the plate did not escape, consequently they had no escape of gas on either plate until the cell was full. If the quantities were properly adjusted the two plates would get full together; but the oxygen generally commenced to escape before the hydrogen. In the process, which was quicker than the Plante process, of forming a Faure cell no reversals of currents, as he had said, were used. The operation took a week, or perhaps not so long; the Plante operations took two or three months. In making the Faure cells it was not found easy to keep the coatings on the plates, and the plates had to be wrapped up in felt or cloth. The next improvement consisted in not using coatings at all so much as putting the substance which formed the coatings into interstices in the lead. This was a patent of Mr. Swan and Mr. Sellon. The plates now were all made with perforations, and the substance adhered to them very much better. The Electrical Power Storage Company had been good enough to lend him the specimens of cells, &c., before them. The plates were of two sizes. They were packed together in boxes. The only difference in the cells was in the number of plates. The amount of electricity that could be stored up in the small plates might be stated at 16 ampere-hours, and the current varied from two to three ampere-hours; consequently those boxes which had nine pairs of plates would take a current of about 20 or 30 amperes, and give out about the same. They would

discharge at that rate between six and eight hours, giving out a quantity of about 160 amperes. There was great excitement about the Faure battery when it first came out, and public attention was directed to it to rather an exaggerated extent. Recently the interest in it abated, and very little was known as to what was being done. He had in his laboratory at Liverpool twenty-five of these cells. He found them most invaluable and was surprised at the perfection produced in them during the last year. The difference between putting the coating on the plate and into the interstices struck him as a very small improvement, but if they put it to the test of practice it seemed to be an improvement. The chemical process which went on in discharging the plates was very much the reverse of that which went on in charging. If the cells were kept in full action, they were preserved in a remarkably perfect state of efficiency, but if they allowed them to stand idle and electrically empty the negative plates rapidly sulphated themselves up, and the composition lost its adherence and was apt to tumble out. Many of the defects to be found in cells was due to this ill-treatment. If they kept the battery in action it behaved exceedingly well. The only way to get rid of the sulphate was to apply a small charging current for a long time—a week or a fortnight—and start afresh. The sulphate of lead on the positive plate did not matter so much. The electromotive force of a cell was about two volts. They must never keep the cells full or drain them. They thus got a good return for the energy they put in. The lecturer concluded by briefly referring to meters. Ayrton and Perry's meter, he said, was a remarkable instrument; it was a somewhat striking example of the improvements introduced into pure science by the acquirements of technical science.

Western Union Earnings.

The Directors of the Western Union Telegraph Company met in this city on Wednesday last, and received the last quarterly report. The condition of the company March 31, 1883, was shown to be as follows:

Surplus Jan. 1, 1883, $3,393,885.24; net revenues quarter ended March 31, 1883, $1,677,818.51; total, $5,071,703.75; from which deduct dividend 1¾ per cent., payable April 16, $1,399,767.25; interest on bonded debt, $106,600; sinking funds, $20,094; total, $1,526,461.25; leaves a surplus April 1 of $3,545,242.50. The net revenues for the quarter ending June 30, based upon nearly completed returns for April, partial returns for May, and estimating the business for June, it was reported, would be about $1,725,000, which, added to the surplus April 1, makes $5,270,242.50. From this amount there will be appropriated $106,700 interest on bonded debt, $20,000 for sinking funds, and $1,399,750 for a dividend of 1¾ per cent. on the capital stock just declared. The surplus, after paying everything, including the dividend, will be $3,743,792 50. It was resolved that the dividend of 1¾ per cent. be made "payable on and after July 16, and on removal of legal restraint prohibiting such payment, to stockholders of record on June 30," and that "the books of transfer of the capital stock of the company in New York and London be closed at 3 o'clock of the afternoon of June 30, and be reopened on the morning of July 17 next." John Jacob Astor was elected a director in place of the late Amasa Stone, and John T. Terry was elected a member of the Executive Committee in place of the late Hon. E. D. Morgan.

New Cables.

It is rumored that a company has been organized in this city for the purpose of laying two ocean cables between this country and Europe.

The details of this new project will be made public in a short time. Meanwhile it is learned on good authority that the enterprise is in strong hands, and in such a forward state as to leave no doubt of its speedy success.

Telephonic.

Notes from Maine.

The telephone business is still growing in Maine. There are about 3,000 subscribers in the State.

The principal exchanges are located in Portland, Bangor, Augusta, Lewiston, Bath, Biddeford and Rockland, with several other smaller systems.

Trunk lines connect nearly all of these exchanges together, and with New Hampshire and Massachusetts.

The trunk lines are longer than the average lines in the other New England States, owing to the fact that the larger cities in Maine are scattered; the lines, however, are well built and work nicely. The heaviest business on these lines is between Portland and Lewiston. Heavy business transactions in grain and other merchandise are daily carried on. The multiplicity of trunk lines are not yet necessary in Maine; hence, one reason for their remarked smooth working.

Portland is a city of 33,810 population, with a telephone list of 840, being about one subscriber to every forty of the inhabitants. Subscribers are still coming in at the rate of from ten to twenty per month, while very few are discontinuing their instruments. Additions are also being made in nearly all the other exchanges in the State.

The rates in Portland range from $30 for a residence per year on circuit line, to $60 per year for special line to business parties or private residences.

New and elegant rooms, with one of the best switch systems, has this spring been arranged for the Portland Exchange. The switch contains several novel improvements, which have been mentioned in previous issues of this paper. One of the latest additions to the office is a simple and effectual device for saving gas at night. The room is so large that six lights are necessary whenever connections are to be made. Two little spring keys are placed on each and every section; pressure of the finger upon one key at either section will quickly turn all the gas flames down to a mere taper, while a touch on the other key will as quickly turn all the lights up to full blast. So, no matter at which section the night operator may be seated when a call comes in, he can turn up his lights and turn them down again at whatever section he may have completed his connection. The arrangement is entirely simple, while it is perfect; no gas can possibly escape.

There is one subscriber in the exchange who hires two sets of instruments, so he need not bother to run up or down stairs when he is called!

Another private residence desired an arrangement of instruments so that he *only* could use it. To best accomplish this a simple standard lock was put on the inside of the crank bolt, and a spring fastened in front of the door in such a position, and with such wire connections, that on throwing the bolt of the lock it made electrical contract with the spring, thus cutting out generator coils and telephone. The key is inserted from the front, of course.

At some stations troubled by non-subscribers, a little secret button has been arranged, so that no one can call central office unless they are acquainted with the position and working of this secret switch, which must be operated to take off a "cut-out."

(Signed) I. H. F.

THE CENTRAL UNION TELEPHONE COMPANY LICENSED—ITS OBJECT.

A charter of incorporation was granted yesterday by the Secretary of State to the Central Union Telephone Company, the incorporators being Robert C. Clowry, De Launcy H. Louderback, and Charles S. Holt, and the capital stock $6,275,000. Mr. Louderbach, who is managing director for the Western, Central, and Midland Telephone Companies was called on, and said that the specific object of the new company was the building and operation of telephone lines in undeveloped districts over the United States. Telephoning was rapidly assuming immense proportions, and this was simply another company to be added to those already existing. They intended to have telephones between cities—say central offices connecting all the towns in a given country—but he did not think long distance telephoning was practicable, or at least that it could be made a paying investment. They had not decided on their programme of operations yet, having only just made the first start by obtaining a license, but he presumed the operations of the company would cover a large field, and include everything connected with the telepnone business—the manufacture and sale of telephones, for example. He could give fuller information when Colonel Clowry, who was one of the incorporators, got back, the latter being at present out of the city.

A meeting of the stockholders of the Central District and Printing Telegraph Company, of Pittsburg, Pa., has been called for July 13, for the purpose of considering the advisability of increasing the capital stock of the company from $500,000 to $1,000,000. The officers say the increase is necessary in order to enable the company to keep pace with the demand for telephone facilities, and also to meet the expense of the introduction of underground wires. Over three thousand instruments are now in use in the towns of Western Pennsylvania, Eastern Ohio and West Virginia.

The Boston *Herald* says the Lowell syndicate was among the recent bidders for the territory of Louisiana and Mississippi, but was outbid, according to a dispatch from Manager Downs in New Orleans, which said: "Other parties have closed. As you did not deem it advisable to bid higher than the other parties, I concluded to let it go." The successful bidders are understood to be a syndicate now operating in Tennessee. Had the Lowell people secured the States aforenamed, they would, it is said, have consolidated the territory with that covered by the Southwestern Company.

Mr. E. Berliner, Chief Inspector of the American Bell Telephone Company, says in a letter to the editor of the London *Electrician* that many of the phenomenas which are reported by experimenters on loose carbon contacts, notably those in the very interesting observations by Mr. Stroh, are, in my opinion, clearly due to carbon dust on the surface of the solid pieces.

It is important that the contract surfaces should be permanent and very hard and homogeneous, and I beg to suggest that the carbons used for these experiments be carefully washed in clear water and afterwards dried. Even an apparent smooth surface brought about by polishing is not reliable, and should be tested by washing the surface under water with the finger or a piece of cloth.

To definitely settle the loose contact transmission, the apparatus ought not only be free of carbon dust, but the current employed ought to be so low and the carbons so hard that no burning can take place. The action by means of detached carbon particles—an arc—is a special phenomenon, and different from a so-called "contact" transmission, and it has ever been the aim of those who first conceived the "contact" principle in telephony to confine themselves to that principle. The time is near at hand when it will be clearly proved that the so-called microphone is merely a contact transmitter of defective mechanical construction, that its name is misapplied, and that the apparent increase in sound is partly due to the scraping of the parts in contact, partly to the fact that the telephone is pressed closely to the ear and excludes all other sounds.

The many theories brought up to explain the microphone, viz.: "Heat," "arc," "variation of contact area," "number of molecules in contact," "compression of carbon"—all these lack positive proofs, are obscure and confounding, and some have been shown to be wrong; but somehow or other there seems to be in some quarters too much pride to confess that such theories are wrong, and the "practical," though less "scientific" workers, who, through laborious experiments had long arrived at the correctness of their own now acknowledged theory are silently ignored.

At Berne the Stæmpfli printing establishment, desirous of profiting by recent inventions for the perfecting of its machinery and to facilitate the work in its shops, has adopted the Edison system of electric lighting in the place of gas. The light is distributed by means of porcelain reflectors and permits the printers by night without fatigue to the eyes and without being incommoded by the heat of the gas-jets. The lamps are fed by a Thury dynamo machine, constructed in the factory of Messrs. Meuron & Cunéod.

BOSTON, Mass., June 4, 1883.

Messrs. Delano & Co, 23 Park Row, N. Y.

GENTLEMEN: Yours of 31st ult. is received. I shall look for our advertisement in your next issue. As for urns regarding our company it might be interesting for you to know that besides having acquired the exclusive right to export American Bell Company's telephones and apparatus to our countries, which will shut off all exports of genuine goods except those we ship, we have secured a recent patent covering the Bell telephone in all Brazil, and all infringing shipments will hereafter be embargoed and confiscated at all Brazilian ports.

We have also secured a concession for Venezuela, and shall do all the telegraph business in that country by arrangement with the Government.

Exchanges are being started at Carracas and La Guayra, and trunk lines connecting the two cities, and the system will be started in Valencia and Maraicaito. Our exchange at Barbadoes has over 100 subscribers, and from the profits there we are building one at Trinidad.

At Demarara the Government has applied for 50 sets, and an agent is there now arranging for a complete system.

All the sub-companies are in good working order, and we are shipping a large lot of goods per "Advance" to Rio, June 6.

Buenos Ayres reports under date of April 29 917 actual paying subscribers—101 being new subscribers since August 1st to 29th. The Chilian Company will start four large exchanges before July 1, and altogether we are well pleased with the large business done so far this year and our present prospects. We are without debt of any kind—good amount of cash on hand and money coming from various sources, and no exchange requiring large outlay of funds except that the sub-companies support from their own treasuries. Very truly yours,

H. S. RUSSELL, President. J. H. HOWARD, Vice-President.
CHAS W. JONES, Sec'y and Treas. JAS. H HWOARD, General Manager.
Principal Office, 95 Milk Street, Boston, Mass.

There is some talk of establishing a cotton factory at Parahyba do Sul, Province of Rio de Janeiro, for the purpose of giving employment to the poor and developing the growth of cotton in that locality. Would it not be better to inaugurate such a factory as a paying business enterprise?—*The Rio News.*

Performance on the Tight Wire.

Mr. Jerry Sullivan, who has charge of the Fox Building, corner of Main and Preston streets, Houston, used to boast that the building was less troubled with rats than any other large building in the city. But of late he has not had much to boast of in that way.

The rodents have been invading the building in considerable numbers every night, and just how they got there was a question that puzzled him much.

Some time ago, however, the question was solved when on a night when the moon was shining brightly Jerry discovered a whole string of rats crossing over on the electric light wires. He could "scarce believe the

witness that his eye received," but as he had but recently joined the temperance society he knew that they were not rats of his imagination, as strange as the performance appeared. He told the reporter of it, and reporters are not generally incredulous, but this rat story was too much for him, and the scribe did not dare publish the fact until he saw with his own eyes a similar performance a few nights ago.

The wires being insulated with cloth makes them easy of travel for the rats, and it is marvelous with what ease they cross the street upon them.

The reporter suggested to Mr. Sullivan what he thought might prove an effective remedy to this rat immigration, and told him to twist a piece of sheet tin around the wires in the shape of a cone with the apex toward the opposite side of the street, and when the rats attempted to surmount this obstacle the cone would turn and drop them into the street and break their legs or necks. Sullivan thought this an excellent idea, and the next night he tried it, but he attempted to put the dead-fall on the wires about the time the electric lights were turned on, and despite the fact of the wires being insulated, he received a shock which came near dropping him into the street like he had intended to drop the rats, and the rats still cross, much to Jerry's discomforture.

The eminently temperate reporter who divested himself of the above is known within the circulation of the *Age* as Dud. (not dude) Bryan. Had any other of the town's newspaper staff been guilty of giving it currency, suspicion would point with the finger of certainty to an over-allowance of imagination and lager beer, superinduced by a too steady diet of variety theatre. But with the stamp of such authority it must pass unquestioned, and deductive reasoning must place the responsibility of the presence of cockroaches inside of said building to its former occupacy by the Western Union Telegraph and Southwestern Telephone offices.

This is a matter toward which the attention of electricians should be immediately called. If dynamo-electric machines are likely to bombard the premises of electric light patrons with rats, and other batteries are given to firing off cockroaches, very serious objections will soon be raised to the use of these conveniences inside of city limits. I would hesitate to give publicity to this matter because of the damaging use that gas companies could make of it, did I not think that our Edisons could speedily devise some means of overcoming the obstacle.

FOSTER.

HOUSTON, Texas, June 5, 1883.

SARATOGA, June 8.—In the Court of Appeals to-day, the case of William S. Williams and Rufus Hatch, respondents, against the Western Union Telegraph Company, appellants, was argued on appeals from orders granting new trials, made by the General Term of the New York Superior Court, reversing the judgments for defendants of the Special Term in May, 1881, on the grounds of errors of law by Judge Truax. The actions were brought by the plaintiffs severally, as stockholders in the Western Union Telegraph Company, against the said company, its directors, and the Union Trust Company, to obtain adjudication determining that certain agreement made by the Western Union Telegraph Company with the American Union Telegraph Company, and the Atlantic and Pacific Telegraph Company is void, and for relief against the execution of such agreement, and reaching beyond to the personal liabilities of the directors of the Western Union Telegraph Company. The main ground of complaint relates to the alleged invalidity of the agreement in law. The Western Union Telegraph Company appealed from orders of the General Term granting a new trial, stipulating for judgment absolute against it, if either order was affirmed by the Court of Appeals. The separate or individual defendants did not appeal. Argument was opened by General Wager Swayne for appellants. He held the floor until noon, when he yielded to the Hon. William M. Evarts' memorial of ex-Judge Addison Gardiner. Gen. Swayne will conclude his argument on Monday. He is to be followed by Aaron P. Whitehead and Robert Sewell for the respondents. The Hon. William M. Evarts will close for appellants. The hearing will probably continue until Tuesday.

The Rapid Extension of the Lowell Telephone Companies' Business.

The telephone companies under Lowell management made the following net increase of subscribers during the month of May :

	Added.	Now connected.
National Bell of Maine.	36	3,916
Boston and Northern...	169	3,329
Bay State.....	116	2,705
Suburban.....	88	1,390
Union.....	20	350
Northwestern.....	322	1,842
Granite State	3	426
Total.....	754	13,958

The Southwestern Company has about 2,800, with orders ahead for about 400 more. This makes a total under the management of 16,758. The stocks under the management of the Lowell syndicate are firm and have advanced several points within the last few days. The advance is substantiated by the large increase of subscribers for May, which is given above. Northwestern is scarce at 65. Southwestern is held at 65, with a prospect of reaching 70 or 75 in a few days. The rapid rise in this stock from 50 is due to the favorable telegrams received from General Manager Downs, who is now on a tour of inspection in the territory. Under date of Dallas, Tex., June 13, he says: "My investigation of this territory has proven it more favorable than we have ever stated. There is chance to build several hundred miles of ex-territorial lines connecting cities and towns within a 50-mile radius, that will create a business in excess of any Eastern lines. I had a meeting of all division superintendents to-day, and am satisfied the men are of the right sort, great ability, and capable of largely increasing the business. We have orders ahead for 400 subscribers." Boston and Northern is steady at 163@166; Bay State at 133@136; Suburban at 140@144; Union at 112, and Granite State at 90@93.

By a recent act of Congress experiments will soon be in progress for determining exact values for several electrical constants. By the act a committee of the recent electrical congress, consisting of Prof. Rowland, of the Johns Hopkins University, Prof. Trowbridge, of Harvard, and Prof. Barker, of the University of Pennsylvania, has been authorized to undertake these experiments, and the work has been so apportioned that Prof. Barker will determine the resistance of a given volume of mercury, Prof. Trowbridge will experiment on atmospheric electricity, and the most important feature, the determination in absolute measure of the standard of electrical resistance, the ohm, will fall to Prof. Rowland, who will be assisted by Messrs. Kimball and Goodenow. The work will be done at Clifton, a suburb of Baltimore It will begin in September, but the work of placing the necessary apparatus in position will go on during the summer.

The New York and Pennsylvania Telegraph and Telephone Co., with executive headquarters in the Western Union Building, is still pushing matters in the field, under the direction of General Manager Eastabrook, of Elmira, and his assistants. It is now building over five miles of pole lines each working day, in addition to its local operations, having constructed within the last sixty days about 250 miles of substantial pole lines, now making over 500 miles outside of the exchanges. Seventy-two new subscribers were connected in May, and an exchange opened at Waverly, N Y. During June the new Wellsville exchange will also be in operation. The gain in subscribers for the quarter will exceed 200. The different oil centers in Pennsylvania and New York are being brought within speaking distance of each other, much to the satisfaction of producers and dealers, who are just now "helloing" to each other to lively changes in prices. The company expects, before September 1st, to complete fully three-fifths of the direct wires designed to cross its territory from east to west.

The production of rails of various descriptions in the United States last year was as follows: Bessemer steel, 1,438,155 tons; iron, 227,874 tons; open hearth steel, 22,765 tons; total, 1,688,794 tons. The corresponding production in 1882 was as follows: Bessemer steel, 1,330,202 tons; iron, 488,581 tons; open hearth steel, 25,217 tons; total 1,844,100.

One hundred and twenty-five numbers of Lovell's Library have now been issued. The new cover in two colors is a decided improvement upon the old one. It is soon to be brought out at the rate of one copy per day, and by fall all of the works of Dickens, Thackeray, Black, Bulwer Lytton, Eliot and Jules Verne, as well as many of the most popular of the current works of fiction, can be had in this convenient 12mo form. The prices range from ten to twenty cents per copy.

At the Telephone.

(*From the Spoopendyke Papers.*)

"Now, my dear," said Mr. Spoopendyke, standing before the telephone and preparing to explain its mysteries and advantages to his wife—"now, my dear, this is going to prove the most convenient thing we ever had in the house. When I want to talk to any one, I just turn this crank and say, 'Hello, hello!' and the girl at the central says, 'Hello, hello!' and I tell her who I want, and she calls him up. Now, I'll ask for Mr. Speklewottle." And Mr. Spoopendyke turned the crank, utterly forgetting to press the button that makes the connection.

"What does he say?" asked Mrs. Spoopendyke, cocking her head to one side, as a woman always does when her husband is trying to listen.

"He don't say anything yet," growled Mr. Spoopendyke. "He ain't like you. He waits until he has got something important on his mind, and then he says it. Hello, hello!" roared Mr. Spoopendyke, giving the crank a vicious twist and glaring into the enunciator with a vindictive look. "Now you keep that mouth of yours tied up, or you're liable to lose it some day!" with which doleful prognostication Mr. Spoopendyke rattled away at the crank, and awaited some sign of life at the other end.

"I suppose it is really that girl's fault," murmured Mrs. Spoopendyke, sniffing at the instrument as though she smelled the young lady from afar, and found her no better than she ought to be. "I don't suppose she's there at all. More likely she's gadding around somewhere."

"What'd ye want to talk just then for?" howled Mr. Spoopendyke. "What's your measly object in breaking out with the conversational small-pox at that critical juncture? Don't you know she was just beginning to talk, and you made me lose her? I tell you one thing," added Mr. Spoopendyke, with impressive solemnity, "if you don't shut your mouth once in awhile, the moths will get in there and make you trouble."

"If she'd only just commenced to talk, you haven't lost her," replied Mrs. Spoopendyke, wrinkling her nose. "You'll have no trouble with her if she's got started."

"Hello, hello! call up Mr. Specklewottle!" bawled Mr. Spoopendyke, apparently convinced by his wife's manner or his own experience. "There, she's gone. No use for me to try anything when you're around. Another time I want to talk through a telephone, I'll take it over in a vacant lot! Do you know of anything that will keep you quiet for a moment?" demanded Mr. Spoopendyke, his wrath rising as he contemplated his ill usage. "Never mind the expense. Just name the article! Why didn't you tell me, when you referred me to your measly old dad, that I was proposing marriage to a dod gasted steam dictionary?"

"Say, dear, can I talk through it?" cooed Mrs. Spoopendyke, anxious to disarm her husband.

"Is there anything you can't talk through?" squealed Mr. Spoopendyke, beginning to realize that there was something about the telephone that he did not thoroughly understand. "When I get a telephone for you, the diaphragm will be of doubled and twisted wrought steel with railroad tracks for wires, and I don't believe that will last more'n an hour and a half! Hello, hello-o-o! wake up and call up Specklewottle, dod gast ye!" and Mr. Spoopendyke rattled away at the crank until his arm ached.

"Be patient, dear. You said she'd gone, and it's a long way around to Mr. Specklewottle's house. Perhaps he isn't home, and she's waiting for him."

"That's the way it works, eh?" shrieked Mr. Spoopendyke, glaring at his wife. "It took you to get hold of it! When I call that girl she goes home to dinner, and along in the evening she goes around to Specklewottle's house and brings him here in a hack! That's your idea of it? Or p'raps you've got some sort of a notion that she runs the wire through Specklewottle, turns on the current, and slams him right up here through the side of the house? That your idea? Well, she don't, and she don't break her back trying to make a dod gasted idiot of herself, like some women!"

"I think I understand how it works," faltered Mrs. Spoopendyke. "You say, 'Yellow, yellow——!"

"There's the combination!" yelled Mr. Spoopendyke. "You got your work in that time! Why didn't you tell me I was bringing this thing home to the inventor? What'd you want to let me stand up here and explain this thing to the only comprehensive brain that ever tackled it for? You've got it! With what you know now and what you've got to find out, you only need a wig and a lawsuit to be the whole science of electricity. I tell ye this is the way it works!" and Mr. Spoopendyke brought the box a kick that splintered it. "See it work?" he demanded, pulling at the wires until they cut his hands. "Watch it, while I convey your regards to the other lunatics!" and he danced on the remnants of the instrument and smashed the fragments against the wall.

"Never mind, dear," remonstrated Mrs. Spoopendyke, puttering around after him and trying to soothe him. "When we want Mr. Specklewottle again, we'll just send a servant around after him. That'll be much nicer than trusting to a nasty wire, and I know there was a draught through that box, for I could feel it as soon as it come in the room."

"Oh, you could feel it!" roared Mr. Spoopendyke, rather wondering how he was going to account to the company for the destruction of his box. "If I had your sensitiveness and an onion, I'd hire out as a dod gasted orchin!" and with this culminating sarcasm, Mr. Spoopendyke crushed his hat over his ears and rushed around to Mr. Specklewottle's to see what had better be done about the matter.

"I don't care," murmured Mrs. Spoopendyke, as she flopped down on the floor to pick up the pieces of the wrecked telephone box; "he'll not have any opportunity for standing up here and talking to that girl until his legs are tired," and with this sage expression of her satisfaction over the result of the experiment, Mrs. Spoopendyke broke off the ends of the bent wires and laid them away to crimp her hair on.

Our contemporary, the *Evening Post*, says: Mr. Robers Waters, teacher of language and literature in the Hoboken (N. J.) Academy, believes "that the one thing needful to obtain a good practical knowledge of the English tongue is the careful study of the best, most idiomatic English writers." Among these, he considers William Cobbett a master of "pure, correct, vigorous, idiomatic Saxon English." He has, therefore, prepared a work, called "How to Get On in the World, as Demonstrated by the Life and Language of William Cobbett; to which is added Cobbett's English Grammar, with Notes," (James W. Pratt). The book is designed especially for young men, and is a study in life as well as in language. The biographical part details the struggles of Cobbett, from the station of a poor ploughboy to that of a leading writer of his age (1762–1835).

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We extend to manufacturers of electrical apparatus an invitation to send to this office any and all facts concerning their business which will be of interest to the public. We make no charge for publishing news.

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The Importance of Perseverance in Electrical Enterprises.

The many successes and the long list of failures that have, during the past few years, been recorded in the electrical field furnish data, not only valuable to the moralist but also to the inventor and experimenter. We have seen men develop great successes from beginnings of but little promise, and, on the other hand, sink into obscurity, if not bankruptcy, with what there was reason to believe would prove of almost inestimable commercial value.

The general error of those who possess powerful understandings is, that they form schemes of too great extent and flatter themselves too hastily with success; they feel their own force to be great, and by the complacency with which most men survey themselves, imagine it still greater. They therefore look out for undertakings worthy of their abilities, and engage in them with very little precaution, for they imagine that without premeditated measures they shall be able to find expedients in all difficulties. They are naturally able to consider all prudential maxims as below their regard, to treat with contempt those securities and resources which others know themselves obliged to provide, and disdain to accomplish their purposes by established means and common gradations.

Precipitation, thus incited by the pride of intellectual superiority, is very fatal to great designs. The resolution of the combat is seldom equal to the vehemence of the charge. He that meets with an opposition that he did not expect loses his courage. The violence of his first onset is succeeded by a lasting and unconquerable languor; failure makes him fearful of giving way to new hopes, and the contemplation of an attempt in which he has fallen below his own expectations is painful and vexatious. He therefore turns his attention to more pleasing objects, and habituates his imagination to other subjects, till, by slow degrees, he quits his first pursuit and suffers some other objects to take possession of his thoughts, in which the same ardor of mind promises him again certain success, and which disappointments of the same kind compel him to abandon.

Thus, too much vigor in the beginning of an undertaking often intercepts and prevents the steadiness and perseverance always necessary in the conduct of a complicated scheme, where many interests are to be connected, many movements to be adjusted, and the joint effort of distinct and independent powers to be directed to a single point. In all important events which have been suddenly brought to pass, chance has been the agent rather than reason, and therefore, however those who seemed to preside in the transaction may have been celebrated by such as admired or feared them, succeeding times have commonly considered them as fortunate rather than prudent. Every design in which the connection is regularly traced from the first motion to the last must be formed and executed by calm intrepidity, and requires not only courage which danger cannot turn aside, but constancy which fatigues cannot weary, and contrivance which impediments cannot exhaust.

An Electrical Highwayman.

For cool, unadulterated assurance, commend us to the English. Long since they discovered, or rather awoke to, the fact that, so far as ingenuity was concerned, they were no match for the Yankees, and ever since they have ceased to exert themselves, finding it infinitely more remunerative to appropriate Yankee designs, add what they are pleased to term improvements, and then calmly claim the whole thing.

It is not very long ago that an Englishman, an alleged scientist, arrived here in search of ideas. He visited the workshop of a man who has since become well known in the electric-light field. The Englishman, who was possessed of good letters of introduction, desired to be shown, as a matter of curiosity, through the workshop. He said he had no intention of going into the electrical field—indeed, that he had not sufficient means to do so, even were he so disposed. The condition of his apparel and the color of his nose gave color to the last assertion. *Macbeth* made use of a fine bit of hyperbole when he said that the great ocean would not wash his hand clean from the blood-stains on it, but that his hand would, rather, incarnadine the great ocean. So the visiting Englishman might have declared that, no matter how white that electric light was that illumined the workshop he was visiting, no matter how bright that moon whose silver beams threw a sheen upon the grass without—the reflection from his nose would, despite all, suffice to diffuse a ruby glow.

A credible witness of the stranger's arrival sums up his worldly effects as consisting of a battered suit of pepper-and-salt-colored wool, a grip-sack of by no means robust dimensions (containing two paper collars, a hair brush, and three bottles of a dark-colored fluid), and a nerve that the broadside of a line-of-battle ship could not shake.

But, if his worldly possessions were limited, his memory was phenomenally good, and it served, upon his return to his native land, to recall to his mind every detail of the ingenious contrivances which had been shown him by the too-confiding Yankee inventor.

At the present time the former wanderer upon these shores is the vice-president of a large electric-lighting company in London, whose office is not far from Portman Square, and which lays claim to a system of lighting to which they have as just a right as has the highwayman to the watch of the unsuspecting traveler whom he has robbed. The countenance of the present vice president, which when he was in this country wore a cringing, deprecating expression, now assumes an air of haughty disdain and aristocratic hauteur, and the nasal protuberance that decorates the middle of his face, once a faithful exponent of the effects of bad whiskey, has, through the influence of more southerly vintages, acquired a more mellow and less fiery hue.

This man is now looked up to with great respect by his fellow co-workers, just as the chief of banditti is regarded with awe by those who have not been so successful in thievery. So powerful, indeed, does he seem to be that he is enabled, by a system the processes of which we have not been as yet able to discover, to have inserted in English scientific journals, *in the news columns*, paragraphs which serve at once to hoodwink the English public and uphold his pretensions. Read this, taken from *Engineering*:

"The Brush Company of the United States appears to be growing tired of the persistent infringements of their patents, and have given notice that they are pressing for a decision of the suits now pending in New York City, and that, if they are given in their favor, they will take immediate action against the users of the apparatus which is complained of, as well as against the makers. The great patience hitherto displayed by the patentees of electric-light apparatus, under the continued appropriation by others of what is presumably valuable property, has given rise to a belief in this country that their virtue is generally the result of necessity, and that their specifications would not bear the investigation of a court of law. Unfortunately, the results of a trial in the United States would not form a reliable basis from which to determine the value of an English patent, owing to the difference of practice in the two countries."

This is a little too good. It is the old story of the culprit doubling on his pursuers, and crying with even more vehemence than they, "Stop thief!"

First, our former visitor gives it as his opinion that the claims of the American electric-lighting patents, one of which he has stolen, will not bear the investigation of a court at law, and then, in order to be ready to hedge in any event, declares that, even if these men did establish a legal claim to their property, they could not recover it from the thieves, because in England, where property is shown to be stolen from foreigners, it may not be recovered, nor the thief prosecuted.

Tardy Telephonic Enterprise.

The *Bulletin des Téléphones* congratulates the Belgians upon the recent passage of the telephone bill in the Belgian Chamber of Deputies, and enumerates the many benefits that are likely to accrue in consequence. The *Bulletin*, we think, might have gone a step further and explained to the Belgians what they have lost by their failure in long since urging the passage of this bill.

"Look before you leap" is undoubtedly a good rule to observe, but, like many another trite saying, encourages a cautiousness in those who are governed by it which may safely be set down as worse than precipitation. "Nothing venture, nothing gain," is also a trite saying, which, unlike this class of proverbs generally, contains a cold fact. The Belgians have waited long after the efficiency and economy of the telephone was assured. They have waited until other countries have been almost covered by a net-work of telephone wire, until they have been looked upon as behind the times; their caution laid to the door of stupidity, and their consideration of what has already been authoritatively settled, set down as ignorance. They remind us of the old fellows in the wilds of Pennsylvania and the Maine woods, who are said to be still voting for Andrew Jackson.

The Belgian Minister of Public Works has reserved the right of connecting the cities by telephone, and claims other privileges, and this assumed prerogative of the State will, there is reason to believe, do much toward retarding that private enterprise which always results in furthering the interests of the public.

Competition is the life of trade, and monopoly is an enemy to the public interests. When the telegraph came into general use, even he who was inclined to use the mail was forced to become its patron in order to keep abreast of his neighbors. Now, even if telegraph rates were exorbitant, he would be compelled to use the wire between two points controlled by the same interest, and if this interest was represented by a Government which prohibited these lines from being constructed, he would have absolutely no appeal.

When the Belgian Government establishes its telephone lines, the public must pay whatever is demanded; and when favorites and the ne'er-do-well relatives of the Crown or the Ministry are provided with lucrative sinecures, how can such lines compete in cheapness of rates with those operated by private companies, where none are overpaid, and waste is unknown.

Against this, doubtless, some of our esteemed foreign contemporaries will insist that the fact that here in America the telegraph service is a monopoly, breaks the force of the argument. A consideration of the matter, however, will easily show the fallacy of this. There is practically no telegraph monopoly here. If the Western Union Telegraph Company should demand exorbitant rates between any two or more points, other companies would quickly spring into existence as competitors, and build new lines between those points. Any man is, or any body of men are, privileged to build telegraph lines anywhere in the United States and Territories. The Western Union could not and would not attempt to prevent it. But if the Belgian Government, for instance, claims a telegraph or telephone monopoly between certain points, there is an end to the matter. No one would be permitted to construct or operate lines in the section proscribed.

Look at the vast number of railroads in the United States which run almost parallel to each other. Who is benefited by this? The public to be sure. This healthy competition results in forcing down freights and fares, and the result is that nowhere in the world is railway transportation so cheap as it is here. But, if such service was claimed by the Government as its right, there would never be more than one line between any two points, and the public might, to use a slang phrase, either pay whatever was demanded or stay at home.

We congratulate the Belgians upon finally being awakened to the benefits of telephone service, even though this awakening has been somewhat late in the day; but if it were retarded until the year 1900, we should still congratulate them.

The telephone is a reality. It is a convenience which, when once enjoyed, cannot thereafter be dispensed with. It laughs at distance, levels mountains, and bridges floods.

Electrical Notes.

We learn that the Administration of State Railways in France has definitely and exclusively adopted the Achard electric brake.

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The Minister of Marine has decided to have the French marine participate in the International Exhibition of Electricity at Vienna. The officers on service at Paris have been invited to indicate what apparatus of their invention they would desire to see displayed at the Exhibition.

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The electric railway in the Kostverloren Park, near Amsterdam, will be in operation all this summer.

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There exists in America and in Europe a number of electrical laboratories belonging to private persons who take an interest in electricity, and who are constantly employed in making experiments. One of the largest of these laboratories belongs to Mr. Louis Crossley at Moorside, near Halifax, in Yorkshire (England). One room is reserved for chemical researches and another for machines. The latter contain one of the finest assemblages of apparatus for facilitating experiments that can be seen anywhere. These apparatus have been collected during a period of twenty years. All sorts of arc and incandescent lamps are disposed on wooden chandeliers, and wires run in all directions, some for lighting and some for the transmission of force necessary to operate a tramway outside of the house, which is surmounted by an electric lighthouse furnished with a holophotal lense of 15° divergence.

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The electric lighting of the Place du Carrousel, Paris, which is made by Lontin-Bertin machines and de Mersanne regulators, is definitely authorized by the Municipal Council for a new period extending to November 18th, 1883.

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On the occasion of the annual festivals, the cities of Seville, Cordova and Grenada, in Spain, were illuminated by the electric light. It has become a custom in all the cities of Spain to use the electric light for the illuminations which take place on the occasion of different festivals. Electric lighting for all purposes has made great progress in Spain. The *Société Espagnole d'Electricité*, for example, which manufactures machines, arc and incandescent lamps, and covers its own conducting wires, is about to organize a special factory for electric light carbons.

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At Barcelona it has been decided to light by electricity the theater *du Lyceé*, one of the largest theatres in the world.

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For the year 1883, the grand prize of the mathematical sciences, consists of a medal valued at $600, will be on the question "To perfect in any important point the theory of the application of electricity to the transmission of force."

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An international reading-room, specially reserved for works treating on electricity, will be established at the Vienna Exhibition of electricity. This room will be lighted solely by electric lamps. There will be found all the books, journals and reviews of the day of different countries, relating to electric science.

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The laying of a sub-marine cable is projected between the Island of Cuba and Spain. The cable will be divided into three sections, one from Portugal to the Azores, the other from the Azores to Bermuda and other from Bermuda to Havana. From Bermuda the cable will be connected by a sub-marine line 750 miles long to New York. From Havana another cable will connect with the telegraph lines of Central America. The price fixed for messages from Spain to Cuba is 30 cents per word.

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A new electric cable, of three conductors, has been laid between Italy and Sicily for the Italian Government, by the Eastern Telegraph Company.

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A Frenchman, possessor of an estate in Russsian Poland, Count Alexander de Choiseul Gouffier, has established a telephone system, using the telegraph lines existing on his property, situated nine miles from Memel.

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The opening is announced at Malta, No. 27 Strada Mercanti, of a central telephone office, which is open night and day. The subscription is $40 per year for all distances. The number of subscribers to date is 48. There are besides several branch offices for public use.

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In Cuba, the offices of the *Diario de la Marino*, a journal published in Havana, have an Edison installation.

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Santiago, the capital of Chili, has already had for some time a central electric lighting station, established by the Edison Company of New York, and which furnishes lights to several factories and private houses.

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In Cuba, several sugar plantations have electric light installations.

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A new departure has been made in Paris, with respect to telephone service for private parties. It consists in the introduction of a smaller type of the Ader transmitter and receiver, with a view to the establishment of small telephone exchanges in the interior of public buildings, banks, hotels, etc. A complete post, of the new model, costs only $20.

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The *Société Générale des Téléphones* is about to install a new calling system, which presents advantages over the system now in use. With the new apparatus, when once the communication is established between two subscribers, these will be able, by pressing on a special button, to call each other by signals on the bells, without their ringing being confounded at the central office with the signals which indicate the end of the communication. In this manner subscribers can momentarily suspend their conversation, without being obliged to keep the telephone to the ear and then calling again to be re-connected.

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Ader telephones are now placed with a number of proprietors of factories in Paris and its environs, who have their houses and their places of business connected by means of private telegraph lines. The subscribers can thus use the telephone or the telegraph, at will.

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In La Villette, capital of the Island of Malta, a central office has been opened in the Rue Mercanti. Ader transmitters and receivers are used. The wires are all of phosphor-bronze. The office, of which the director is the Chevalier Edward Rosenbusch, is open night and day. The annual subscription has been fixed at $40 (forty dollars). Among the places connected are the Theater Royal, the Bourse, the *Chambre des Avocats*, the railway station and the public offices.

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At Biala and Cracow, concessions for telephone lines have been demanded of the Austrian Government.

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In Austro-Hungary the salt pits of Maros-Ujvar have an electric light system of 28 arc lamps. Steam engines supply the motive power.

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At Buda, Pesth, the distillery of Grunewald & Co. is receiving an electric lighting installation of Swan lamps.

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At Vienna, Austria, the principal hotel has been lighted with a trial system of Swan lamps.

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The Bohler Foundry, at Waidhofen, in Lower Austria, where are fabricated a great quantity of sickles, sword blades, scythes and cutlery, has been furnished with an installation of incandescent lamps.

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At Pesth, Hungary, the telegraph office has been furnished with 200 Swan lamps. This installation, made by Messrs. Ganz & Co., of Buda-Pesth, is limited to ten years.

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In South Africa, at the Kimberley Mines, there has been made an installation of 32 Brush arc lamps, fed by two machines of 16-light capacity, actuated by a Robey motor. A circuit of three miles and one-half extends around the Kimberley Mine, and the other, of four miles, extends to the De Boer Mine, by the routes of Du Toit Pan and Victoria. This installation was organized by the South African Brush Light and Power Company. The wires are supported partly on house-tops and partly on iron poles.

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In the Colony of Victoria, in Australia, two gold mines are actually lighted by electricity, and other mines are about to adopt the new system of lighting.

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On April 11th, 1883, the *Société Générale des Téléphones* had in Lyons 486 subscribers; in Marseilles, 310; in Bordeaux, 262; in Havre, 193; in Lille, 124; in Nantes, 108; in Rouen, 62; in St. Pierre, Calais, 27; in Oran, 25; and in Alger, 4.

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At Georgetown, capital of Demerara County, British Guinea, a telephone system has been established.

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At Buenos Ayres the Pantelephone Company has amalgamated with the Bell Telephone Company, under the name of "La Union Telefonica del Rio de la Plata." The president of the new company is Major Alexander Wood, of the Western Brazilian Telegraph Company, and its director is Mr. Jones, formerly General Superintendent of the *Societe des Telephones de Berzil*.

***

A project for the establishment of an electric railway has been presented to the Municipal Council of Paris. This electric traction road will be constructed on the exterior boulevards from La Villette to the Place Moncey. It will be 3,363 yards long, and will have nine stations, separated by an average distance of 355 yards. The average height of the roadway will be about sixteen feet. The journey from La Villette to the Place Moncey will be made in twenty minutes. Single cars, circulating at all times in both directions, be will used.

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It is an old and a standing grievance—the poor ventilation in all large telegraph offices, and in many of the small ones, too.

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The trouble, however, is not confined to them alone.

The same is the case in most all places where large numbers of people are engaged in more or less confined quarters.

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There is reason to believe that a remedy would be willingly applied if one could be found, and the cost of application not too great.

If such a belief is well founded, would it not be worth a trial for those in power to introduce a system of light shafting suspended from the ceiling, with fan attachment, similar in character to those at present in use in certain restaurants?

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The expense of such a system would not certainly be very excessive.

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Where dynamo machines are already established, one could be, without much trouble, applied to run a motor, or, in fact, the accumulator has already been far enough advanced towards utility to make it serviceable in this connection.

The effects of such a plan are almost self-evident.

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The air would be under a continual state of movement, and consequently stagnation prevented.

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The wavy motion would be imparted to all parts of the room alike.

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Each individual could then feel reasonably sure of receiving their fair quota of lung-sustaining power.

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And with the windows opened at the top, the same course could be pursued successfully and to advantage as well in winter as in summer.

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There may prove to be obstacles and difficulties in the way of carrying out such a scheme as the above.

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But that should not prevent it from at least receiving a fair trial.

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Something in this direction is certainly necessary, and no time should be lost in making the experiment.

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And the outlay would inevitably return a large income in the shape of better health and better service.

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Let the good work be put under way.

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Considering the rapidity with which the field of electrical labor is extending, and the need felt for the right kind of people to enter therein, should not some steps be taken to bring the seekers and the sought into personal contact or communication with each other?

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And what better medium could be found for this purpose than the New York Electrical Society?

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There are unquestionably many young bright, active and experienced men who would be quite willing to give their best efforts to the successful carrying out of any labor that might be entrusted to them, in new channels where their already acquired knowledge would be a valuable aid, and the prospect of advancement more favorable than it is at present.

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Many feel desirous no doubt of making a change of this kind if they only saw their way clear to do so.

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The gain, however, would be by no means all theirs.

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It is the knowledge they already possess that is to prove the foundation work of the new structures they would be called upon to erect.

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Let some of those in search of such assistance make the application, and see what the result is.

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This would appear to be another of the legitimate objects of the society's organization.

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To make its worth and value as a factor in the extension or promotion of electrical progress felt, ought certainly to be work entitled to and deserving of its earnest consideration.

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If a person asks you if you are paying attention, pray do not answer, "I'm all ears," for there is an insinuation in the assertion which may not redound to your credit. According to the theory of evolution you may be entirely correct, but it is not necessary to make one's confessions in public. Keep your opinion on that delicate matter to yourself.

A Hint to Scientific Writers.*

SCIENTISTS, LAWYERS, AND EVEN CLERGYMEN USUALLY UNGRAMMATICAL.—THEIR STYLE OBSCURE, THEIR SENTENCES INVOLVED.—AN INVALUABLE BOOK FOR SUCH PERSONS DESCRIBED.

It has been said, and there is good evidence to sustain the assertion, that lawyers and ministers, though having more practice in written English than other professional men, do not write the language as well as they.

Those, however, who have read papers written by scientific men will incline to the belief—if familiar themselves with the construction of the language—that their sentences are the most ungrammatical, the most involved, and their meaning the most obscure, of all. As a matter of fact, it is not worse than the English written by the lawyers and the clergy, but, owing to the uncommon terms which must necessarily be introduced, it appears to be.

Now, it is precisely on this account that the scientist should be the more careful with the construction of his sentences, for this reason that he should use as few words as possible, while, at the same time, selecting those which shall exactly convey to the mind of the reader the information which it is sought to impart.

This being the case, therefore, any work or treatise which will enable the scientist to correct his style and improve and simplify his manner of expression, should be hailed by him with pleasure.

Possibly in the whole range of English text-books he would not find a more thorough, a better devised and at the same time a simpler grammar of the English language than that devised by William Cobbett.

Richard Grant White, who is a recognized authority on the English language, has said that it may be better learned by reading the works of well-known masters of English than by the aid of a complex grammar. Most people who have carefully examined the grammars of the day will agree with him in this. But Cobbett's grammar is to these grammars what the interlinear "pony" of the college lad is to the inexplicable Greek or Latin poem which it is designed to elucidate. It doesn't give you the value of x in terms of y, as all other grammars do, and which leads one to the belief that the authors themselves do not thoroughly understand that which they essay to make clear. Cobbett was a perfect master of the English language. He not only spoke it in all its purity, but his writings—and they are almost innumerable—are masterpieces of style.

No man could say more in fewer words than Cobbett, nor could any other than he point out more clearly the direct road to a mastery of our mother tongue.

His admirable criticisms of what among many are thought to be examples of the purer English, and especially his criticisms of the speech delivered by the Prince Regent in 1814, of Lord Castlereagh's note, of the despatches of the Duke of Wellington, and of the Bishop of Winchester's charge, will be found to be of great service in learning how sentences should be constructed, as well as in pointing out what nonsense often results from forgetting persons, numbers and nominatives.

Here is a good example of Cobbett's criticisms: "I have before me," says he, "'a charge delivered to the clergy of the Diocese of Winchester, at a primary visitation of that diocese, by George Tomline, D. D., F. R. S., Lord Bishop of Winchester, Prelate of the Most Noble Order of the Garter.' This bishop was the tutor of that William Pitt who was called the Heaven-born minister, and a history of whose life has been written by this bishop. So that we have here a Doctor of Divinity, a Fellow of the Royal Society, a Prelate of the most noble order of the Garter, and a bishop of one of the richest sees in the whole world. Let us see what sort of writing comes from such a source. I could take an incorrect sentence, I could even take a specimen of downright nonsense, from almost any part of the charge. But I shall content myself with the very first sentence of it. Here it is: 'My reverend brethren: being called to preside over this distinguished diocese at a late period of life, I have thought it incumbent upon me not to delay the opportunity of becoming personally acquainted with my clergy longer than circumstances rendered absolutely necessary.' There are *two* double meanings in this short sentence. Was he called at some former time to preside over the diocese *when he should become old?* or was he, *when he had become old*, called to preside over the diocese? But what follows is still worse. Does he mean that he thought it incumbent on him to become acquainted with his clergy *as soon as possible*, or *in as short a time as possible?* To *delay* an *opportunity* is not very good; and that which is of a man's own appointment, and which proceeds purely from his own will, cannot strictly be called an *opportunity*. But it is the double meaning, occasioned by the *wrong placing* of the words, that the reader should mark."

How easily this sentence, if Cobbett's rules are followed, can be made unequivocal, clear and elegant:

My reverend brethren: being called, at a late period of life, to preside over this distinguished diocese, I have thought it incumbent on me not to delay, longer than circumstances rendered absolutely necessary, the opportunity of becoming personally acquainted with my clergy.

*Cobbett and His Grammar. By Robert Waters. James W. Pratt, publisher, New York.

NEW YORK, June 15, 1883.

Editors Electrical Review:

GENTLEMEN,—Referring to your very interesting article in the last number of your paper, entitled "The Telephone in Submarine Warfare," I desire to enter a vigorous protest against the idea there expressed, that torpedoes alone are, or ever can be, a sufficient defense for a harbor. And I desire the more strongly to do so, because of the prevalence of that idea among intelligent men, and because of the danger that must result from the false sense of security engendered. As long as the people of the United States believe the country to be in a defenseless condition, there is hope that the defenses of the country may be put into a state of efficiency; but if they come to believe that, by means of a few torpedoes and a Leclanché cell, they can protect themselves against a hostile fleet, then any such hope must be abandoned.

Do not understand me as underrating the value of torpedoes. I believe torpedoes to be an ever-ready, a powerful, a necessary item in the defense of a harbor; but I believe that they are only an item, and that they never can constitute the whole of an efficient defense.

Let us look the matter in the face. In the first place, all the navies of the world have progressed as much as we in torpedo warfare, some of them more—notably that of England, by reason of having more money appropriated by the Government for experiments. They understand not only attack with torpedoes, but also defense against torpedoes. They understand (and practically, too) not only the ways of laying out torpedoes to defend a harbor, but also the ways of countermining and harmlessly exploding torpedoes that have been laid. They also understand shelling out persons operating torpedoes. This brings us to the point that the persons operating torpedoes and the torpedoes themselves need protection.

In any efficient system of harbor defense, the torpedoes should be laid out with great exactness, and should be controlled from operating rooms containing electrical apparatus and instruments of precision in the hands of trained and careful men. Now, it must be clear that, to render the system effective in emergencies, when enormous ironclads are throwing shot and shell weighing several hundred pounds, these operating rooms must be protected absolutely, so that their occupants can work with the care and precision that are essential. It is also clear that, to prevent the enemy from landing a party at a point outside the harbor, which shall cut the communication between the operating rooms and the torpedoes in the water, the conductors must be in underground channels, and that there should be a strong force of soldiers to repel an assault.

It must also be clear that, to prevent the enemy's boats, covered by the guns of their ships, from countermining the torpedoes, these torpedoes should be commanded by numerous guns, and that the approach of the enemy's ships should be restricted by heavy rifles of range and penetration. In order to mount such guns and protect them so that they can be well aimed, forts of great strength are a necessity; while, to get what may be termed an adjustable fire, and to operate the most efficient torpedo, the movable torpedo, ships and floating batteries should patrol the water.

An English admiral would not desire a more pleasant entertainment than (if torpedo defense alone were used) to come into the lower bay with his large ships, shell Brooklyn and the lower part of New York with shell weighing not quite a ton, send his smaller ships ahead to blow up the torpedoes, and then move gradually up towards the city, knocking down, by way of signaling his approach, the Western Union Building, the Equitable Building, the Post Office, the Fifth Avenue Hotel, and a few others, and then asking a hundred million dollars to stop. A hundred million dollars would be a cheap price to pay to keep New York, Brooklyn and Jersey City from destruction.

Should any reader think my ideas as to the power of an English fleet to be exaggerated, I would respectfully refer him to the English Navy Register, or any other authority from which he can gather an idea as to the progress of ordnance and ship building abroad.

We think that we have made enormous progress in electrical science. So we have. But let it not blind us to the fact that electrical science is not the only science in which enormous progress has been made. This morning's paper spoke of a ship recently designed by Sir Edward Reed, the great English naval constructor, in which the machinery is put in the upper part of the vessel, and in which the lower part is made up of numerous cells, the design being to resist torpedo attack.

Let us not, then, put such unrestrained confidence in torpedoes, or in any other one system of defense, as to make us incapable of considering the question as a whole; but let us consider torpedoes as an important branch of electrical science, and one to play a very important, though not the only part, in the defenses of our country.

I have the honor to be,

Very respectfully,

BRADLEY A. FISKE,
Lieutenant U. S. N.

Sundry News Items.

(*Translated for the* ELECTRICAL REVIEW *from La Lumière Electrique.*)

At the closing of the Electrical Exhibition of Munich, there was formed in that capital a syndicate, with the view of facilitating electro-technical enterprises. Presided over by Mr. De Maffei, Councillor of the Kingdom, the syndicate includes among its members a great number of prominent men. Its efforts are principally directed toward rendering Bavaria independent of other countries in the domain of electricity, and to aid the general and local governments in all investigations which may lead to practical results. Wherever there is a possibility of creating electro-technical establishments the society will lend its aid, and even take charge directly of the execution of the work.

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The Czar of Russia has just accorded to the *Société Technique Russe*, of St. Petersburg, presided over by Prince Kotschoubey, the sum of 15,000 roubles, to aid the formation of the Russian section at the International Exhibition of Electricity at Vienna. Mr. Welitscko, who represented the Russian department at the International Exhibition at Paris in 1881, has been charged with the organization of the Russian group at Vienna.

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Experiments are being made in Vienna with a new electrical accumulator invented by a Viennese.

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We have lately mentioned the employment of electrical lighting in theaters. Mr. Tchikoleff informs us of still another installation, made by him during August, 1882, in the Theater Korch, at Moscow. The system has been working ever since its installation, and the theater does not now possess a single gas burner, nor any other artificial light. The lamps are distributed through the theater in the following fashion:

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Stage—136 Edison 16-candle lights, and 20 Swan 16-candle lights.

Auditorium—36 Edison 16-candle lights, and 4 400-candle arc lights.

Green-room, corridors, vestibule, refreshment counter, etc.—3 arc lights of 300 candles, and 170 16-candle Edison lights.

Exterior—4 300-candle arc lights.

The scenes include, besides, 4 400-candle arc lights with colored glasses, used for decorative scenic effects.

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We are informed that the electric light has been used for a year in the salt works of Szlatina, in Hungary. The light is furnished by twenty arc lamps, each of 600-candle power, by Messrs. Ganz & Co., of Buda-Pesth, and has given such satisfactory results that the directors of the salt works of Maros-Ujvar have decided to extend this system of lighting in their works, by adding fourteen lamps to the fourteen which are already installed there. These new lamps will be fed by a special alternate-current machine, and the necessary motive force for the operation of the two machines will be furnished by a 35-horse power engine. The new installation will be made by the Ganz Company, with their own machines and with lamps of the Xipernowsky system.

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The same company has also undertaken the lighting of the offices of the Administration of Telegraphs of Buda-Pesth for a period of ten years, with 200 Swan lamps. The installation is to be completed in three months. A few weeks ago the Ganz Company had already effected the lighting of the grain warehouses at Buda-Pesth, by the means of 200 Swan lamps, and the committee empowered to receive them have shown themselves to be well satisfied.

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It also appears that many other installations of this character are to be effected very soon in the Austrian Empire—among others, the distillery of the Messrs. Goynwal and the Villa Rosner, at Buda-Pesth; the factories of Messrs. Bohler & Waidhofer and the Palace of the Arcades, at Vienna. The latter will be illuminated by 250 Swan lamps, at the cost of the occupants.

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Three thousand five hundred Edison lamps and four arc lights, of 40,000-candle power, have been put in operation in Moscow—the lamps on the towers of the Assumption and St. John the Great, and the arc lights on the four turrets of the outer walls.

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At Madrid a decree has been published, giving the concession for an electric cable from Cadiz to the Canary Islands, and another cable from the Canary Islands to Senegal. This new submarine line will form a portion of the system of the Telegraphic Union, and will be subject to the clauses of the St. Petersburg Convention. The *concessionaire* will be required, within the space of two years, to obtain from the French Government the authorization to land the cable on the coast of Senegal. The Spanish Government will assure rapid and regular communication between Cadiz and the French frontier.

Manufacturing News.

The Maumee Rolling Mill Company, Toledo, Ohio, is building a mill, which will be in operation by January 1st, 1884. The capital stock of the company is $500,000.

The new Crozer Furnace, at Roanoke, Virginia, made a very successful start on May 28th. The first cast was a gray forge of fine quality and great strength, weighing about eight tons. The daily output is expected to be from 80 to 100 gross tons.

A company with a capital of $200,000 is forming at Mobile, Alabama, for the purpose of establishing a pig-iron furnace with a capacity of sixty tons daily.

It is understood that the directors of the Puget Sound Iron Company have in contemplation the building of a large rolling mill at Irondale, Washington Territory.

A company of Toronto capitalists is proposing the erection of blast furnaces in that city, and has appealed to the Dominion Minister of Finance for higher duties and an increase of the promised duty of $1.50 per ton on pig iron of domestic manufacture.

The Blakeney Foundry Company, of Springfield, Ohio, recently organized, is building extensive works at that place, for the manufacture of the Blakeney cupola furnaces and general castings.

The Missouri Malleable Iron Company, of St. Louis, Mo., has recently put its works into full operation. The works are supplied with the latest and most improved machinery and apparatus for turning out a general line of malleable castings for agricultural and other castings.

The new foundry of the New Home Sewing Machine Company at Orange, Mass., will be finished in July, and is the largest in the State, having a capacity for 200 moulders and melting thirty tons of iron daily. The building is of brick, 300x60 feet, with a wing 100x60 feet. Machinery has recently been added for ramming the sand and drawing the moulds, which greatly increases the foundry's capacity. The old foundry, as soon as it is vacated, will be used for japanning iron and other purposes. This foundry is now turning out castings for 350 machines daily.

Newberg, S. C., will soon have a new cotton mill, to cost from $175,000 to $200,000. Over $100,000 have been raised, and the prospect is good for the balance. Col. R. L. McCaughrim, of Newberg, is one of the principal movers in this scheme.

The Pennsylvania Railroad Company will build extensive shops at Pomeroy.

Judges McCrary and Love, of Iowa, have given opinions coinciding with Judge Treat, of St. Louis, Mo., denying the application of Washburn & Moen for injunction against the barb wire makers.

It is in order now to recover the excessive royalty which has heretofore been exacted of the makers of barb wire.

The Janesville (Wis.) Cotton Mills were started in 1875. Their first mill contained 200 looms, but in a short time a weave shed was erected so as to run 400 looms, and the preparation was run night and day. In this mill they have turned out 110,000 yards of their 56′ Badger sheetings per week. They are now erecting a new mill, 274x74. The wheel-house is 50x50, all of which is rapidly approaching completion. The power will be supplied by a Victor turbine wheel. Preparations have been made to have another mill, 274x74, built on the other side of the wheel-house so as to bring the power in the center. The old mill was equipped with machinery from the Whitin Machine Company, Whitinsville, Mass., where orders have also been placed for the new.—*Chicago Journal of Commerce.*

The Wachusett Electric Light Company of Fitchburg, Mass., have made a contract with that city to light a considerable portion of Main and Water streets with the Thomson-Houston electric lights.

The Lynn Electric Lighting Company have introduced the Thomson-Houston lights into the new hotel of Soule & Sons, on Nahant Beach.

One of the handsomest of the trade journals is the ELECTRICAL REVIEW, published by Delano & Co., at 23 Park Row in this city, and devoted to the interests of the electric light, the telephone, the telegraph, and applied science in these directions.—*Christian Union.*

The next Congress of the French Association for the Advancement of Science will be held at Rouen from the 16th to the 23d of August, under the presidency of Mr. Fred. Passy.

A decree has been published authorizing the allowance of $16,000 to the Minister of Posts and Telegraphs in view of the participation of France in the International Exhibition of Electricity at Vienna.

The German Government has responded to the invitation of the Austrian Minister of Foreign Affairs to the effect that Germany will take part in the International Exhibition of Electricity at Vienna.

At Geneva the question is being again discussed of furnishing electrically to the city and its suburbs not only light but motive power, using therefor the waters of the River Rhône.

The Central Committee of the Swiss National Exhibition which has just opened at Zurich has recently invited the authorities of the Confederation and the Cantons, as well as the industrial socicties and Swiss trades generally, to participate during the exhibition in the organization of a series of scientific technical conferences.

It is expected that there will be treated and elucidated important questions interesting to the Swiss people, among others that of the applications of electricity.

NEW PATENTS—ELECTRICAL—1883.

INDEX OF INVENTIONS FOR WHICH LETTERS PATENT OF THE UNITED STATES WERE GRANTED IN THE WEEK ENDING MAY 22, 1883.

278,076 Dynamo-electric machine; Charles E. Ball, Philadelphia, Pa.

278,119, 278,120-1-2 Dynamo-electric machine; George W. Fuller, Norwich, Conn.; four patents.

278,277 Device for suspending electric cables; Howard C. Root and John C. Reilly, Philadelphia, Pa.

277,990 Electric train-arrester; Harry W. Carlton, Peoria, Ill.

278,159 Electric pneumatic clock system; Carl A. Mayrhofer, Paris, France.

278,533 Electric wire duct; John C. Goodridge, Jr., New York.

278,289 Electric conductor; Samuel D. Stoohm, Philadelphia, Pa.

278,293 Electric arc lamp; William M. Thomas, Cincinnati, Ohio.

278,087 Insulating underground electric wires; William M. Brisbin, Philadelphia, Pa.

278,028 Lightning-rod; Augustus C. Lobdell; Chicago, Ill.

278,009 Machine for covering electric wire; Wm. Halkyard, Providence, R. I.

277,869 Microscopic illuminator; Edw. Bausch, Rochester, N. Y.

278,304 Regulator for electric arc lamps; Alphonse Isidere Gravier.

278,026 Telephone transmitter; James A Lakin, Westfield, Mass.

FOR THE WEEK ENDING MAY 29, 1883.

278,418 Apparatus for translating electric currents from high to low tension; Thomas A. Edison, Menlo Park, N. J.

278,367 Circuit for telephone exchanges; Charles E. Scribner, Chicago, Ill.

278,419 Dynamo-electric machine; Thomas A. Edison, Menlo Park, N. J.

278,516 Dynamo-electric machine; A. Floyd Delafield, Noronton, Conn.

278,641 Dynamo-electric machine; Edward Weston, Newark, N. J.

278,565 Electric toy; Robert Lembeke, Hoboken, N. J.

278,346 Electrical connector; Harry Long, London, Ontario, Canada.

278,353 Electric switch-board; William J. McElroy, Pittsburg, Pa.

278,536 Electrical insulating material; John Grieves, Paterson, N. J.

278,415, 278,417 Manufacture of incandescing electric lamps; Thomas A. Edison, Menlo Park, N. J.

278,618 Machine for making brackets for telegraph insulators; John B. Smith, Claremont, N. H.

278,619 Machine for making telegraph-insulator pins; John B. Smith, Claremont, N. H.

278,413, 278,414 Regulator for dynamo-electrical machines; Thomas A. Edison, Menlo Park, N. J.

278,640 Regulator for dynamo-electric machines; Edward Weston, Newark, N. J.

278,465 Support for electric-light conductors; Luther Stieringer, New York.

278,351 Telephone circuit; John A. McCoy, Fall River, Mass.

278,357 Time-signal for telephones; John M. Oram, Dallas, Texas.

278,494 Telephone switch; Henry W. Breckenridge, Providence, R. I.

278,627 Underground line; Francis X. Taffe, Baltimore, Md.

A printed copy of the specification and drawing of any patent to the annexed list, also of any patent issued since 1865, will be furnished by any of the patent solicitors whose advertisements appear in this journal. In ordering please state the number and date of the patent desired.

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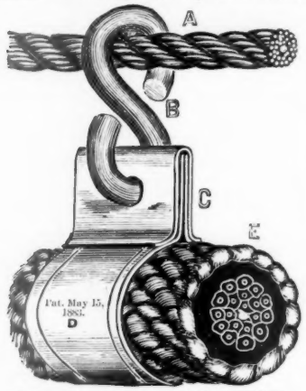

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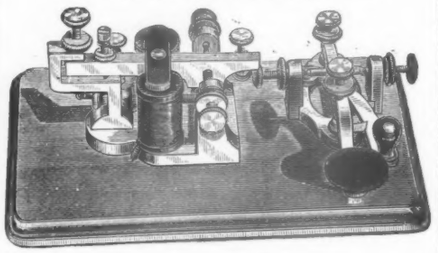

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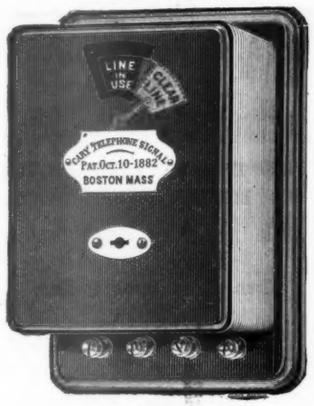

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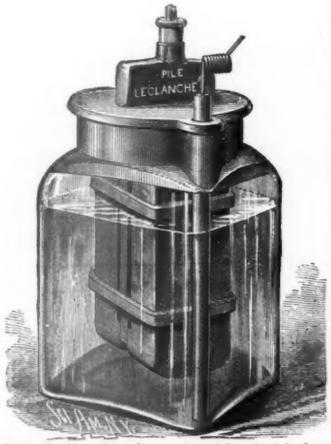

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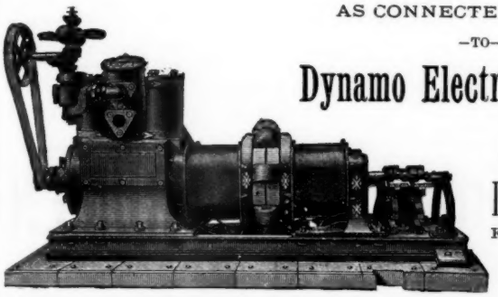

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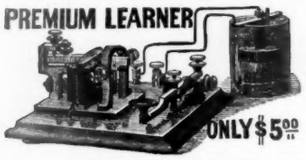

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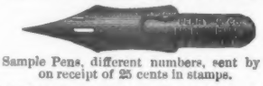

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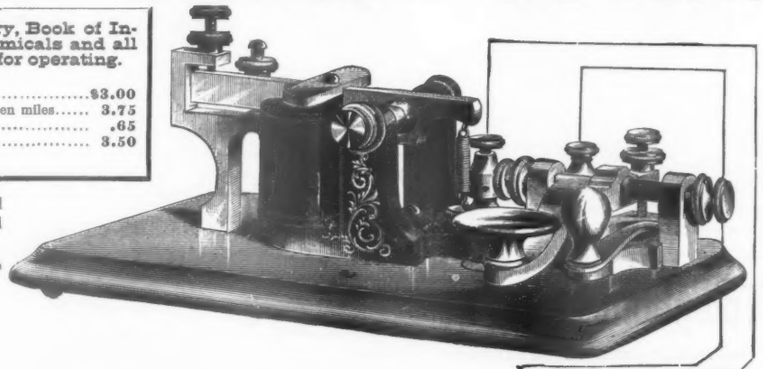

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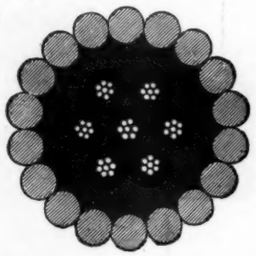

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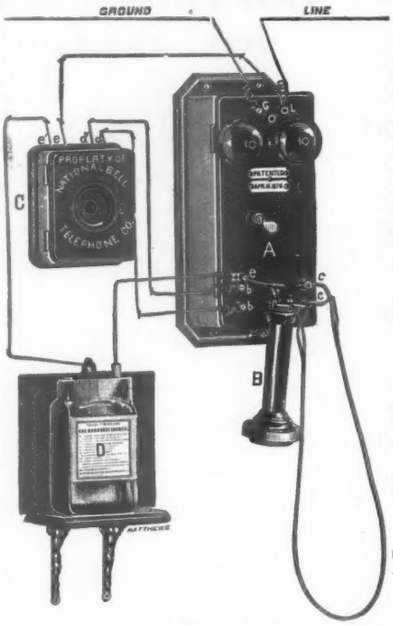

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